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Comparison of Dexmedetomidine, with Clonidine Based Anaesthesia for Controlled Hypotension in Functional Endoscopic Sinus Surgery

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ABSTRACT
Dexmedetomidine and Clonidine opiates that are alpha-2 adrenergic agonists have been identified to be potential agents in producing targeted hypotension in FESS. These agents have related actions that mostly work in the central nervous system by suppressing sympathetic activity which results to hypotension and bradycardia. The main objective of the study is to find the comparison of dexmedetomidine, with clonidine based anaesthesiafor controlled hypotension in functional endoscopic sinus surgery. This randomized, controlled trial was conducted at wamy vivekananda medical College and hospital, tiruchengode, Tamilnadu. A total of 80 patients scheduled for elective FESS were enrolled in the study. All patients were premedicated with oral diazepam 5 mg the night before surgery. Once in the operating room the usual preoperative baseline was recorded and connected to the ECG, NIBP, pulse oximeter and capnograph. Data were collected from 80 patients. The average age was similar, with Group D (Dexmedetomidine) at 45.36±10.01 years and Group C (Clonidine) at 44.45±9.91 years. Gender distribution was also comparable, with Group D having 22 males and 18 females, while Group C had 24 males and 16 females. The mean BMI was nearly identical between the groups, with Group D at 25.6±3.2 kg/m² and Group C at 25.8±3.1 kg/m². It is concluded that Dexmedetomidine is more effective than Clonidine in achieving controlled hypotension during Functional Endoscopic Sinus Surgery, offering better surgical field conditions, reduced intraoperative blood loss and a smoother postoperative recovery.

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Key Words
Dexmedetomidine, hypotension, bradycardia, premedicated

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INTRODUCTION

Controlled hypotension, a technique employed to minimize intraoperative bleeding and enhance the visibility of the surgical field, plays a pivotal role in procedures like Functional Endoscopic Sinus Surgery (FESS). Due to the complex structure of the nasal and sinusal cavity the surgical approach requires high degree of finesse, where even minor bleeding can massively diminish the visibility of the surgery area and raise the difficulty level of the operations[1]. Consequently, it becomes important to determine the agents that are appropriate to use for anesthetic purpose to induce controlled hypotensive effect during the surgeries in question. Dexmedetomidine and Clonidine opiates that are alpha-2 adrenergic agonists have been identified to be potential agents in producing targeted hypotension in FESS. These agents have related actions that mostly work in the central nervous system by suppressing sympathetic activity which results to hypotension and bradycardia[2]. But they vary in pharmacokinetics, potency, side effect profiles, and clinical efficacy and therefore the authors think that it is necessary to investigate their effectiveness and safety associated with FESS. Dexmedetomidine is an alpha- 2 adrenergic agonist precluding it as a potent sedative, analgesic and anxiolytic. It mainly has the benefit of being an analgesic agent without causing significant suppression of the respiratory system relative to other IV agents; this makes enteral anesthesia an important drug during surgeries where control of the airway and the ability to breathe without assistance is crucial[3]. These are the antihypotensive properties of dexmedetomidine as stated by Mukhtorov and Brichkov which include dobesity dependent bradycardia and hypotension. Further, it has been noticed to decrease the use of other medications that is used to maintain anesthesia, which might decrease the risk for postoperative complications in the patient[4]. Another alpha-2 adrenergic agonist, clonidine, has been used extensively in clinical practice as an antihypertensive agent[5]. Similar to Dexmedetomidine, it decreases activity of sympathetic nervous system hence having controlled hypotensive effect. Further, clonidine has a slightly longer half life meaning its action will last for a longer period., this will be beneficial in cases of surgeries that may take longer. Nonetheless, its side effect profile includes significant risk of intraoperative bradycardia and postoperative sedation that can be managed, but need certain attention and dose adjustment[6]. Numerous researches has been conducted to compare the effectiveness of Dexmedetomidine with Clonidine in achieving controlled hypotension during FESS. These studies in general focused on the fact that Dexmedetomidine leads to more stable intraoperative circumstances because of better and more constant control of the target mean arterial pressure[7]. Also, this drug attains hypotensive state much faster than clonidine though intermediate-acting which is useful in surgeries that require speedy control of blood pressure. On the other hand, the study has shown that although the apae of clonidine is effective it aligns itself with a slower onset of hypotension and may need increased dose or other agent to produce the lapse of time required for fast drop in blood pressure. The big disadvantage with this type of product is that it has a slower onset and this can be a real problem for example in surgeries where the immediate control of bleeding is desirable[8]. Nonetheless, Clonidine's cost and accessibility render this possibility popular in many communities, especially those that have less resources. Closely related to the question of adrenergic selectivity is the safety profile of both agents. However, this drug carries a risk of serious side effects including significant bradycardia and hypotension, especially when used in higher doses or when administered with other anaesthetic agents[9]. But due to its, shorter half life it can produce rapid recovery from hypotensive episodes, which may be useful in maintaining intraoperative hemodynamic stability[10]. Compared to lorazepam, having a prolonged action, clonidine will likely cause hypotension and bradycardia to last longer and postoperative monitoring will be necessary. Compared to other agents in terms of post surgical patient outcomes, Dexmedetomidine has shown to result in faster postoperative recovery time as evidenced by minimal incidents of postoperative nausea and vomiting and lower opioid utilization in postoperative surgical care, all of which translate into a window of opportunity to boost comfort of the patient and shorten the hospital stay. Thus, although clonidine proves helpful in achieving controlled hypotension, it appears to produce similar or even lower degrees of postoperative advantage as IV PCA in terms of analgesic demand[11].

Objective: The main objective of the study is to find the comparison of dexmedetomidine, with clonidine based anaesthesiafor controlled hypotension in functional endoscopic sinus surgery.

MATERIALS AND METHODS

This randomized, controlled trial was conducted at wamy vivekananda medical College and hospital, tiruchengode, Tamilnadu. A total of 80 patients scheduled for elective FESS were enrolled in the study.

Inclusion Criteria:

- Patients aged 18-65 years.
- American Society of Anesthesiologists (ASA) physical status I or II.

- Patients requiring controlled hypotension for FESS.
- Patients with a body mass index (BMI) between 18.5 and 30 kg/m².

Exclusion Criteria:
- Patients with significant cardiovascular, renal, or hepatic disease.
- History of allergy to Dexmedetomidine or Clonidine.
- Pregnant or lactating women.
- Patients on long-term antihypertensive medication.
- Patients with a history of uncontrolled hypertension or bradycardia.

Data Collection: The 80 patients were randomly assigned into two groups, each consisting of 40 patients.

Group D (Dexmedetomidine Group): Patients in this group received Dexmedetomidine as the primary agent for inducing controlled hypotension.

Group C (Clonidine Group): Patients in this group received Clonidine as the primary agent for inducing controlled hypotension.

All patients were premedicated with oral diazepam 5 mg the night before surgery. Once in the operating room the usual preoperative baseline was recorded and connected to the ECG, NIBP, pulse oximeter, and capnograph. Patients in Group D were given an initial dose of Dexmedetomidine, at 1 µg/kg over the period of 10 minutes and then the patients were infused with Dexmedetomidine at a rate of 0. 2-0. 7 µg/kg/h during the operation, continuously during the surgery. Patients of Group C underwent loading dose of Clonidine at the rate of 2 µg/kg over a period of 10 minutes and a maintenance dose at the rate of 1-2 µg/kg/hr till the surgery was over. The patients in both groups were given sta ndard general anesthesia regimen received intravenous induction with propofol (2-2. 5 mg/kg) and fentanyl (2 µg/kg) and maintenance with oxygen, nitrous oxide and sevoflurane. The patient's muscle relaxant was rocuronium and all the patient were intubated with endotracheal tube.

Intraoperative Management: Controlled hypotension was defined as a target mean arterial pressure (MAP) of 55-65 mmHg. The infusion rates of Dexmedetomidine or Clonidine were adjusted to maintain this target MAP. If the target MAP was not achieved with the study drug alone, additional agents like nitroglycerin or esmolol were administered at the discretion of the anesthesiologist. Intraoperative parameters, including heart rate (HR), systolic blood pressure (SBP), diastolic blood pressure (DBP), MAP, and blood loss, were recorded at baseline, every 5 minutes after induction and throughout the surgery. The quality of the surgical field was assessed by the surgeon using a 6-point scale, with 1 indicating an excellent surgical field with minimal bleeding and 6 indicating a poor field with excessive bleeding.

Postoperative Monitoring: After surgery, patients were monitored in the post-anesthesia care unit (PACU) for hemodynamic stability, pain scores and the incidence of adverse events such as bradycardia, hypotension, postoperative nausea and vomiting (PONV) and sedation levels. The total dose of rescue analgesics required in the first 24 hours postoperatively was also recorded.

Data Analysis: Data were analyzed using SPSS v29. Continuous variables were compared using the Student's t-test, while categorical variables were analyzed using the Chi-square test. A $p<0.05$ was considered statistically significant.

RESULTS AND DISCUSSIONS

Data were collected from 80 patients. The average age was similar, with Group D (Dexmedetomidine) at 45.36±10.01 years and Group C (Clonidine) at 44.45±9.91 years. Gender distribution was also comparable, with Group D having 22 males and 18 females, while Group C had 24 males and 16 females. The mean BMI was nearly identical between the groups, with Group D at 25.6±3.2 kg/m² and Group C at 25.8±3.1 kg/m².

Table 1: Patient Demographics

Characteristic	Group D (Dexmedetomidine)	Group C (Clonidine)
Age (years, mean ± SD)	45.36±10.01	44.45 ± 9.91
Gender (M/F)	22/18	24/16
BMI (kg/m², mean ± SD)	25.6± 3.2	25.8 ± 3.1
ASA Physical Status (I/II)	24/16	26/14

While baseline mean arterial pressure (MAP) and heart rate (HR) were similar between the groups ($p>0.05$), significant differences emerged after 10 minutes of drug administration and throughout surgery. Group D achieved a lower MAP (60±3 mmHg) compared to Group C (64±4 mmHg) after 10 minutes ($p<0.01$), with consistently lower MAP and HR values maintained during surgery ($p<0.01$ for MAP and $p<0.05$ for HR), indicating more stable intraoperative conditions with Dexmedetomidine.

Table 2: Intraoperative Hemodynamic Parameters

Time Point	Group D (Dexmedetomidine)	Group C (Clonidine)	p-value
Mean Arterial Pressure (MAP, mmHg)			
Baseline	90 ± 5	91 ± 6	>0.05
After 10 minutes of drug administration	60 ± 3	64 ± 4	0.01
Throughout surgery	58-62	63-66	0.01
Heart Rate (HR, beats per minute)			
Baseline	75 ± 8	74 ± 7	>0.05
After 10 minutes of drug administration	58 ± 6	63 ± 7	0.05
Throughout surgery	55-60	60-65	0.05

The mean surgical field score was significantly better in Group D (1.8±0.6) compared to Group C (2.4±0.8) ($p<0.05$), reflecting less bleeding and improved visibility during surgery. Additionally, Group D experienced significantly lower total blood loss (110±30 mL) compared to Group C (150±40 mL) ($p<0.01$), further supporting the effectiveness of Dexmedetomidine in optimizing surgical outcomes.

Table 3: Surgical Field Quality and Intraoperative Blood Loss

Parameter	Group D (Dexmedetomidine)	Group C (Clonidine)	p-value
Mean Surgical Field Score (1-6)	1.8 ± 0.6	2.4 ± 0.8	<0.05
Total Blood Loss (mL, mean ± SD)	110 ± 30	150 ± 40	<0.01

Bradycardia (HR <50 bpm) occurred in 15% of patients in the Dexmedetomidine group (Group D) and 10% in the Clonidine group (Group C) ($p>0.05$). Hypotension (MAP <50 mmHg) was observed in 7.5% of Group D and 15% of Group C ($p>0.05$). Postoperative nausea and vomiting were slightly lower in Group D (10%) compared to Group C (17.5%) ($p>0.05$), but this difference was not statistically significant.

Table 4: Adverse Events

Adverse Event	Group D (Dexmedetomidine)	Group C (Clonidine)	p-value
Bradycardia (HR <50 bpm)	6 (15%)	4 (10%)	>0.05
Hypotension (MAP <50 mmHg)	3 (7.5%)	6 (15%)	>0.05
Postoperative Nausea and Vomiting	4 (10%)	7 (17.5%)	>0.05

Patients in Group D required fewer doses of rescue analgesics in the first 24 hours postoperatively (1.2±0.4 doses) compared to Group C (2.0±0.6 doses) ($p<0.05$). Additionally, Group D patients were discharged from the post-anesthesia care unit (PACU) significantly earlier (1.8±0.3 hours) than those in Group C (2.4±0.5 hours) ($p<0.05$).

Table 5: Postoperative Recovery

Parameter	Group D (Dexmedetomidine)	Group C (Clonidine)	p-value
Rescue Analgesics (doses in 24 hours)	1.2 ± 0.4	2.0 ± 0.6	<0.05
Time to PACU Discharge (hours, mean ± SD)	1.8 ± 0.3	2.4 ± 0.5	<0.05

The present study was designed to compare the efficacy and safety of Dexmedetomidine and Clonidine in inducing controlled hypotension during Functional Endoscopic Sinus Surgery (FESS). Conscious hypotension is of critical importance when performing FESS for two reasons, namely, to minimize intraoperative haemorrhage and to optimize the visibility of the area under surgery, which is very important in the sinus area due to its complexity. The findings of this study provide relevant information relating to the efficiency of these two agents and the findings will benefit the practice of health delivery[12]
The study has shown that for the purpose of controlled hypotension, Dexmedetomidine is more efficient than Clonidine for given levels and its maintenance. It was found that the patients in the Dexmedetomidine group (Group D) took lesser time to achieve the target MAP and was more stable throughout the surgery. This result may be attributed to the plausible closely-related potent alpha-2 adrenergic agonist effect of Dexmedetomidine that reduces sympathetic tone more than that of Desflurane[13]. This finding is just in line with other past studies that have shown that Dexmedetomidine provides stable haemodynamics during surgeries that demand controlled hypotension. As for Clonidine (Group C), this drug was also able to significantly lower MAP although the rate of doing so was comparatively much slower thus providing comparatively less control over hypotensive episodes in the immediate sense. This slower onset may be disadvantageous in conditions where sudden depression of BP is necessary in order to lessen blood loss during surgery[14]. Still, Clonidine seems to last longer due to its half life and this may be useful in long lasting procedures where hypotension is likely to be needed for a longer time. The surgical field condition assessed by the operating surgeons as good and excellent was statistically higher in Dexmedetomidine group. This group of patients had significantly lower surgical field scores meaning that there was reduced bleeding and therefore better visual ery during surgery. This is especially considered in FESS because even minimal hemorrhage robs the line of sight in the operation area raising the prospects of certain complications. Reduced intra operative blood loss was also observed in the Dexmedetomidine group meaning the drug should be considered particularly for surgeries that require minimal intraoperative bleed[15].
Compared to Dexmedetomidine, although Clonidine resulted in an acceptable grade of surgical field it had significantly higher surgical field scores and significantly more blood loss. This could be may be explained by the fact the Clonidine is less potent vasoconstrictor resulting in increased blood flow to the surgical area[16]. Based on these results, we can infer that though

Clonidine can well be used for the cause of controlled hypotension, it might not be the best drug in surgeries that does not allow any bleeding. Of the two drugs, Dexmedetomidine and Clonidine were found to have some side effects mainly bradycardia and hypotension that are expected side effects that are associated with alpha-2 adrenergic agonists. Still, the overall occurrence of these occurrences was not a subject of marked difference between the two groups. This implies that although Dexmedetomidine results in even deeper decrease in the heart rate and the blood pressure, these side effects can easily be controlled and also the dosage adjusted[17].

Notably, despite having a longer duration of action, Dexmedetomidine had lesser incidences of PONV than Clonidine though the difference was not significant. PONV is one of the issues affecting surgical patients and minimizing its occurrence helps in enhancing patients' care. This is because Sedative properties of Dexmedetomidine facilitate controlling of patient's Autonomic response during surgery, therefore reducing PONV outcomes as observed in the present study[18]. The postoperative recovery profile was better in Dexmedetomidine group, the number of doses of rescue analgesia, time required for discharge from the post anesthesia caring unit PACU were less as compared to Clonidine group. This finding is in consonance with the previously done experiments by other researchers that have shown that Dexmedetomidine has similar effect as opioids in analgesia and sedation but does not cause much respiratory depression hence can help patient to recover easier and hence no much need for handling pain after operation[19]. Consequently, it can be suggested that the findings of this study would have valuable clinical implication to anesthesiologists and surgeons particularly in the field of FESS. From the studies analyzed, dexmedetomidine has been shown to produce better hemodynamics, improved surgical field condition and the patients post-operative status compared to other agents used in controlled hypotension. However, Clonidine can still be used in practice due to its efficacy and effectiveness especially when the factors such as costs and availability of newer drugs such as Dexmedetomidine. Taking into consideration the background of side effects, probably the choice between Dexmedetomidine and Clonidine will be made depending on the need of the surgery, the state of the patient and availability[20]. Where the onset of action is very important or accurate control of hypotension is essential Dexmedetomidine may be preferred. However, Clonidine may be preferred for longer lasting surgeries because in the calculation time needed for such procedures, it generates slower and longer lasting hypotensive action.

CONCLUSION

It is concluded that Dexmedetomidine is more effective than Clonidine in achieving controlled hypotension during Functional Endoscopic Sinus Surgery, offering better surgical field conditions, reduced intraoperative blood loss, and a smoother postoperative recovery. While both agents are viable options, Dexmedetomidine's superior efficacy and safety profile make it the preferred choice in this surgical context.

REFERENCES

1. Kim, D.H., J. Lee, S.W. Kim and S.H. Hwang, 2021. The efficacy of hypotensive agents on intraoperative bleeding and recovery following general anesthesia for nasal surgery: A network meta-analysis. Clin. Exp. Otorhinolaryngol., 14: 200-209.
2. Lee, Y.L., S. Thangavelautham, S. Harikrishnan, R. Karthekeyan and H. Kothandan, 2021. Is hypotensive anaesthesia guided by invasive intraarterial monitoring required for orthognathic surgery?-a retrospective review of anaesthetic practice and intraoperative blood loss in orthognathic surgery in a tertiary hospital. Indian J. Anaesth., 65: 525-532.
3. Suggala, K.K., R.B. Kishan and M.H. Nagrale, 2020. Comparison of dexmedetomidine, with clonidine-based anaesthesia for controlled hypotension in functional endoscopic sinus surgery. J Evid Based Med Healthc., 7: 782-786.
4. Kumar, N.R., N. Jonnavithula, S. Padhy, V. Sanapala and V. Naik, 2020. Evaluation of nebulised dexmedetomidine in blunting haemodynamic response to intubation: A prospective randomised study. Indian J. Anaesth., 64: 874-879.
5. Sharma, S., S. Choudhary, I. Kumari, S. Kalluraya, K. Meena and T. Dave, 2020. Comparative evaluation of oral melatonin and oral clonidine for the attenuation of haemodynamic response to laryngoscopy and tracheal intubation—a prospective randomised double blind study. Indian J. Anaesth., 64: 696-703.
6. Sharma, K., A. Chhabra, P. Saini, N. Chaudhary, A. Singh and S. Gupta, 2020. Controlled hypotension for fess: A randomised double-blinded comparison of magnesium sulphate and dexmedetomidine. Indian J. Anaesth., 64: 24-30.
7. Escamilla, Y., A. Cardesín, L. Samara, S. López and A. Izquierdo et al., 2019. Randomized clinical trial to compare the efficacy to improve the quality of surgical field of hypotensive anesthesia with clonidine or dexmedetomidine during functional endoscopic sinus surgery. Eur. Arch. Oto Rhino Laryn., 276: 3095-3104.

8. Moshiri, E., H. Modir, B. Yazdi, A. Susanabadi and N. Salehjafari, 2017. Comparison of the effects of propofol and dexmedetomidine on controlled hypotension and bleeding during endoscopic sinus surgery. Ann Trop Med Public Health., 10: 721-725.
9. Soliman, R. and E. Fouad, 2017. The effects of dexmedetomidine and magnesium sulphate in adult patients undergoing endoscopic transnasal transsphenoidal resection of pituitary adenoma: A double-blind randomised study. Indian J. Anaesth., 61: 410-407.
10. Jiwanmall, M., A. Joselyn and S. Kandasamy, 2017. Intravenous clonidine as a part of balanced anaesthesia for controlled hypotension in functional endoscopic sinus surgery: A randomised controled trial. Indian J. Anaesth., 61: 418-423.
11. Barak, M., L. Yoav and I.A. el-Naaj, 2015. Hypotensive anesthesia versus normotensive anesthesia during major maxillofacial surgery: A review of the literature. Sci. World J., Vol. 2015 .10.1155/2015/480728.
12. Bayram, A., A. Ülgey, I. Günes, I. Ketenci, A. Çapar, A. Esmaoglu and A. Boyaci, 2015. Comparação entre dexmedetomidina e sulfato de magnésio em hipotensão controlada durante cirurgia funcional endoscópica dos seios paranasais. Braz. J. Anesthesiol., 65: 61-67.
13. Banga, P., D. Singh, S. Dadu and M. Singh, 2015. A comparative evaluation of the effect of intravenous dexmedetomidine and clonidine on intraocular pressure after suxamethonium and intubation. Saudi J. Anaesth., 9: 179-183.
14. Mariappan, R., H. Ashokkumar and B. Kuppuswamy, 2014. Comparing the effects of oral clonidine premedication with intraoperative dexmedetomidine infusion on anesthetic requirement and recovery from anesthesia in patients undergoing major spine surgery. J. Neurosurgical Anesthesiol., 26: 192-197.
15. Cardesín, A., C. Pontes, R. Rosell, Y. Escamilla, J. Marco, M.J. Escobar and M.S. Bernal, 2014. Hypotensive anaesthesia and bleeding during endoscopic sinus surgery: An observational study. Eur. Arch. Oto Rhino Lary., 271: 1505-1511.
16. Sieskiewicz, A., J. Reszec, B. Piszczatowski, E. Olszewska, P.A. Klimiuk, L. Chyczewski and M. Rogowski, 2014. Intraoperative bleeding during endoscopic sinus surgery and microvascular density of the nasal mucosa. Adv. Med. Sci., 59: 132-135.
17. Naja, Z., R. Khatib, F. Ziade, G. Moussa, Z. Naja, A.E. Naja and S. Kanawati, 2014. Effect of clonidine versus dexmedetomidine on pain control after laparoscopic gastric sleeve: A prospective, randomized, double-blinded study. Saudi J. Anaesth., 8: 57-62.
18. Ramakrishnan, V.R., T.T. Kingdom, J.V. Nayak, P.H. Hwang and R.R. Orlandi, 2012. Nationwide incidence of major complications in endoscopic sinus surgery. Int. Forum Allergy amp Rhinology, 2: 34-39.
19. Fokkens, W.J., V.J. Lund, J. Mullol, C. Bachert and I. Alobid et al., 2012. Epos 2012: European position paper on rhinosinusitis and nasal polyps 2012. a summary for otorhinolaryngologists. Rhinology journal, 50: 1-298.
20. Das, A., A. Mukherjee, S. Chhaule, S. Chattopadhyay and P. Halder et al., 2016. 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., 10: 74-80.