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A Comparison Between Dexmedetomidine and Esmolol for Induced Hypotension in Functional Endoscopic Sinus Surgeries

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ABSTRACT

Background and goals of study: *Induced Hypotension is a method used to reduce bleeding and thereby improve the quality of surgical field during FESS. This study compares the efficacy and safety of Dexmedetomidine and Esmolol as hypotensive agents in Functional Endoscopic Sinus Surgeries.*

Methods: *We included 60 ASA I &II patients in the study. Patients were randomly allocated to two groups. Group A (n= 30) : Patients receiving Dexmedetomidine. Group B (n= 30) : Patients receiving Esmolol. In Group A, patients received loading dose of 1 µg/kg Dexmedetomidine diluted in 10 ml 0.9% saline infused over 10 min, before induction of anesthesia, followed by continuous infusion of 0.4 – 0.8 µg/kg/h. In Group B, patients received Esmolol as a loading dose 1 mg/kg, infused over 1 min, before induction of anesthesia, followed by continuous infusion of 0.4-0.8 mg/kg/h. The surgical field was assessed using Average Category Scale. Intraoperative hemodynamic parameters were recorded.*

Results: *Both Dexmedetomidine and Esmolol were effective in maintaining the intraoperative mean arterial pressure within the target range. Heart rate, systolic blood pressure, diastolic blood pressure and mean arterial pressure were comparable between the two groups during the intraoperative period till the stoppage of the study drug. Average Category Scale was comparable between the two groups.*

Conclusion: *Both Dexmedetomidine and Esmolol are effective in providing ideal surgical conditions during Functional Endoscopic Sinus Surgery.*

KEYWORDS : Induced Hypotension, FESS, Dexmedetomidine, Esmolol

INTRODUCTION:

Controlled hypotension or induced hypotension is a technique in which the arterial blood pressure is decreased in a predictable and deliberate manner in order to facilitate surgery and to reduce bleeding and transfusion requirement1. The main aims of controlled hypotension are to reduce intraoperative blood loss and to improve quality of surgical field visualization.

Indications for controlled hypotension are arbitrary and are dependent on the site and extent of surgery, and patient conditions. Intraoperative bleeding can cause poor visibility of surgical field and is of major problem during Functional Endoscopic Sinus Surgery (FESS), as it prolongs the duration of surgery and many complications may arise as a result of impaired visibility.

To control intraoperative bleeding during Functional Endoscopic Sinus Surgery, various means such as an epinephrine injection into the nasal mucosa, reverse trendelenberg position, or hypotensive anaesthesia have been adopted2. Various drugs such as β-blockers, vasodilators, Calcium Channel Blockers, and anaesthetic drugs like propofol, opioids and inhalational agents are being used to achieve controlled hypotension.

Very high concentration of inhalational anesthetics is required to achieve a significant reduction in bleeding, when used alone. This can result in delayed recovery and at times, renal or hepatic injury. Intravenous hypotensive drugs are easy to administer, have faster onset of action, and have effects that disappear quickly when administration is discontinued. They have rapid elimination without toxic metabolites. The hemodynamic effects of intravenous hypotensive agents are much more predictable and dose-dependent.

Dexmedetomidine, a centrally acting α-2 agonist, has been used in achieving controlled hypotension. Dexmedetomidine has sedative, analgesic and anesthetic sparing effects, which are very beneficial.

Esmolol is an ultra short acting selective β-1 adrenergic antagonist that is frequently used for induced hypotension. Esmolol also has additional advantages of opioid sparing effect and reduced postoperative analgesic requirement3. Intraoperative use of esmolol reduces anesthetic requirements and reduces the use of opioids perioperatively4-12.

This study is designed to compare the efficacy and safety of Dexmedetomidine and Esmolol as hypotensive agents in Functional Endoscopic Sinus Surgeries.

Methodology:

This is a prospective, randomized, analytical comparative study, conducted at the Department of Anaesthesiology, Kanyakumari Government Medical College, Nagercoil, Tamilnadu.

Ethical committee approval & written informed patient consent were obtained. The aim of the study was to compare the efficacy of Dexmedetomidine and Esmolol for induced hypotension in Functional Endoscopic Sinus Surgeries (FESS), taking into account the following:

- Hemodynamic parameters- Systolic Blood Pressure, Diastolic

Blood Pressure & Mean Arterial Pressure, Pulse Rate, End Tidal Cabon dioxide, SPO2 - intraoperatively & postoperatively
- Average Category Score for assessment of intraoperative surgical field
- Any complications

This was a randomized, prospective, single blinded, comparative study.

The study was started after receiving Institutional Ethical Committee approval and written informed consent from all the patients.

Sixty patients were studied, randomized into two groups of 30 each. Simple randomized sampling was done by computer generated random numbers.

Patients were allocated into two groups:
- Group A (n= 30) : Patients receiving Dexmedetomidine
- Group B (n= 30) : Patients receiving Esmolol

Patients belonging to age 20-50 yrs and ASA I &II classes were included in the study. Patients belonging to ASA grade III and IV, those with known allergy to study drug, recurrent sinus surgery, hypertension, coagulopathies or receiving drugs influencing blood coagulation, coronary artery disease, renal, hepatic or cerebral insufficiency, and patients on adrenergic blocking drugs were excluded from the study.

All patients were premedicated with IV Glycopyrrolate 5µg/kg and IV Midazolam 0.05 mg/kg. Patients were induced with IV Propofol 1-2 mg/kg. IV Fentanyl 2µg/kg was given for intraoperative analgesia. Endotracheal intubation was facilitated with IV Atracurium 0.5 mg/kg with suitable sized cuffed tube. Anesthesia was maintained with Sevoflurane 1.5%. All patients were mechanically ventilated with Nitrous oxide and oxygen (60% : 40%).

In Group A, patients received loading dose of 1 µg/kg Dexmedetomidine diluted in 10 ml 0.9% saline infused over 10 min, before induction of anesthesia, followed by continuous infusion of 0.4 – 0.8 µg/kg/h.

In Group B, patients received Esmolol as a loading dose 1 mg/kg, infused over 1 min, before induction of anesthesia, followed by continuous infusion of 0.4-0.8 mg/kg/h.

Patients were placed in a 15° reverse Trendelenburg position to improve venous drainage. In both groups cottonoids soaked with epinephrine in a concentration of 1:200,000 was inserted into the nasal cavity and in between the polyps to minimize blood loss.

Hemodynamic parameters such as Pulse Rate, Non invasive blood pressure (Systolic Blood Pressure, Diastolic Blood Pressure & Mean Arterial Pressure), End Tidal Carbon dioxide and SPO2 were recorded every minute for the first 5 minutes and every 5 minutes during the first hour, and every 15 minutes thereafter, until the end of surgery. For statistical purposes they were documented at 0, 1, 2, 3, 4, 5, 10, 15, 30, 45 and 60minutes, depending on the duration of surgery, and at 5 and 10 minutes after stoppage of study drug.

Intraoperatively, the Mean Arterial Pressure was maintained within a range of 55-65 mmHg, by adjusting the dose of the study drug within the dose range specified earlier. If the MAP was higher than the desired range even with the maximum dose of the study drug, the MAP would be reduced by increasing the Sevoflurane concentration. If the MAP dropped below 55 mmHg, the blood pressure was raised by reducing the dose of the study drug to the lowest dose mentioned earlier. If this measure fails to raise the blood pressure appropriately, graded doses of Inj. Ephedrine would be used. If the pulse rate fell below 50 beats/minute, Inj. Atropine would be used to correct it.

When the MAP reached the desired range (5565 mmHg) and was maintained for at least 10 minutes, the surgeon estimated the quality of the surgical field using a predefined category scale adopted from that of Fromme et al.

Table 1: Average Category Scale for Assessment of Intraoperative Surgical Field 13

0	No bleeding
1	Slight bleeding – no suctioning of blood required
2	Slight bleeding – occasional suctioning required. Surgical field not threatened
3	Slight bleeding – frequent suctioning required. Bleeding threatens surgical field a few seconds after suction is removed
4	Moderate bleeding – frequent suctioning required. Bleeding threatens surgical field directly after suction is removed
5	Severe bleeding – constant suctioning required Bleeding appears faster than can be removed by suction. Surgical field severely threatened and surgery not possible

Infusion of the study drug was stopped five minutes before the anticipated end of surgery. Sevoflurane was stopped at the end of the surgery. Residual neuromuscular blockade was reversed with Neostigmine (0.05 mg/kg) and Glycopyrrolate (0.01 mg/kg).

RESULTS

The pulse rates remained comparable between the two groups throughout the intraoperative period, till the stoppage of the study drug. At 5 minutes (75.40 ± 5.49 vs 69.27 ± 4.57; p value <0.0001) and 10 minutes (85.20 ± 6.31 vs 70.93 ± 4.51; p value <0.0001) following stoppage of the drug, the pulse rates in Esmolol group were significantly higher than that in Dexmedetomidine group.

Intraoperative Systolic Blood Pressure remained comparable between the two groups during the first 30 minutes of surgery. At stoppage of the study drug, the

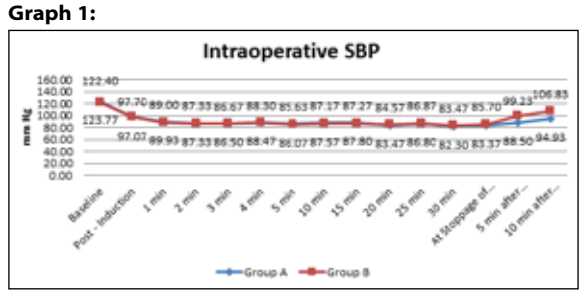
SBP was significantly higher in the Esmolol group compared to the Dexmedetomidine group (85.70 ± 3.48 vs 83.37 ± 4.15; p value 0.022). At 5 minutes (99.23 ± 5.07 vs 88.50 ± 4.50; p value <0.0001) and 10 minutes (106.83 ± 8.75 vs 94.93 ± 5.81; p value <0.0001), the SBP was significantly higher in the Esmolol group compared to the Dexmedetomidine group.

The intraoperative Diastolic Blood Pressure remained comparable throughout the intraoperative period, even after stoppage of the study drug.

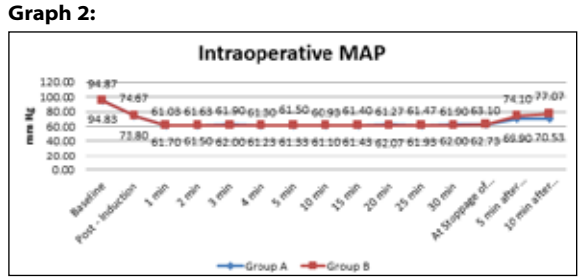
The Mean Arterial Pressures remained comparable between the two groups till the stoppage of the study dug. At 5 min (74.10 ± 6.51 vs 69.90 ±3.98; p value 0.004) and 10 min (77.07 ± 5.53 vs 70.53 ±3.00; p value < 0.0001), the Mean Arterial Pressures were significantly higher in the Esmolol group compared to that of the Dexmedetomidine group.

The Average Category Score to assess the quality of surgical field was comparable between the two groups at 10 min, 20 min and 30 min during the surgery.

Graph 1:



Graph 2:



DISCUSSION

In our study, we observed that there was a significant fall in heart rate and blood pressure following induction in both the groups. Both the drugs were effective in maintaining the intraoperative mean arterial pressure within the target pressure of 55 – 65 mm of Hg. No other additional drugs or Sevoflurane were needed to maintain the MAP within the desired range. The hemodynamic parameters such as heart rate, systolic blood pressure, diastolic blood pressure and mean arterial pressure were comparable between the two groups during the intraoperative period till the stoppage of the study drug. These findings were similar to the findings in the study conducted by Erbesler et al14. The quality of surgical field, assessed by the operating surgeon using Average Category Score, was comparable between the two groups at 10 min, 20 min and 30 min of surgery. This finding was in concurrence with the findings in the study conducted by Tarek et al15.

Systolic blood pressure was lower in the Dexmedetomidine group at the time of stoppage of the study drug (83.37±4.15 vs 85.70±3.48; p value 0.022). After stoppage of the study drug, the pulse rate, systolic blood pressure and mean aterial pressure were significantly lower in the Dexmedetomidine group (measured at 5 min and 10 min after stoppage of the study drug), while diastolic blood pressure remained comparable between the two groups.

CONCLUSION

Both Dexmedetomidine and Esmolol are effective in providing ideal surgical conditions during Functional Endoscopic Sinus Surgery.

REFERENCES:

1. Surjya Prasad Upadhyay, Ulka Samant, Sudhakar Seth Tellicherry, Sheriyar Mallik, Partha P Saikia, Piyush N Mallick. Controlled hypotension in modern anaesthesia: a review and update. International Journal of Biological & Pharmaceutical Research. 2015; 6(7): 532-542.
2. Pavlin JD, Colley PS, Weymuller EA Jr, Van Norman G, Gunn HC, Koerschgen ME. Propofol versus isoflurane for endoscopic sinus surgery. Am J Otolaryngol 1999; 20: 96–101.
3. Miller's Anesthesia, Eighth Edition
4. Chia YY, Chan MH, Ko NH, Liu K. Role of beta-blockade in anaesthesia and postoperative pain management after hysterectomy. Br J Anaesth. 2004;93(6):799-805.
5. White PF, Wang B, Tang J, Wender RH, Naruse R, Sloninsky A. The effect of intraoperative use of esmolol and nicardipine on recovery after ambulatory surgery. Anesth Analg. 2003;97(6):1633-1638
6. Coloma M, Chiu JW, White PF, Armbruster SC. The use of esmolol as an alternative to remifentanil during desflurane anesthesia for fast-track outpatient gynecologic laparoscopic surgery. Anesth Analg. 2001;92(2):352-357.
7. Collard V, Mistraletti G, Taqi A, et al. Intraoperative esmolol infusion in the absence of opioids spares postoperative fentanyl in patients undergoing ambulatory laparoscopic cholecystectomy. Anesth Analg. 2007;105(5):1255-1262.
8. Johansen JW, Flaishon R, Sebel PS. Esmolol reduces anesthetic requirement for skin incision during propofol/nitrous oxide/ morphine anesthesia. Anesthesiology 1997; 86: 364±71
9. Johansen JW, Schneider G, Windsor AM, Sebel PS. Esmolol potentiates reduction of minimum alveolar isoflurane concentration by alfentanil. Anesth Analg 1998; 87: 671±6
10. Shukla S, Gupta K, Gurha P, et al. Role of Beta blockade in anaesthesia and postoperative pain management after major lower abdominal surgery. Int J Anesthesiol. 2010;25(1):1.
11. Bhawna, Singh Bajwa SJ, Lalitha K, Dhar P, Kumar V. Influence of esmolol on requirement of inhalational agent using entropy and assessment of its effect on immediate postoperative pain score. Ind J Anaesth. 2012;56(6):535-541.
12. Hwang WJ, Moon YE, Cho SJ, Lee J. The effect of a continuous infusion of low-dose esmolol on the requirement for remifentanil during laparoscopic gynecologic surgery. J Clin Anesthesiol. 2013;25(1):36-41
13. Fromme GA, MacKenzie RA, Gould AB Jr, Lund BA, Offord KP. Controlled hypotension for orthognatic surgery. Anesth Analg 1986;65:6836.
14. Zeynel Abidin Erbesler, Nurten Bakan, Gulsah Yılmaz Karaoren, Muhammet Ali Erkmen. A Comparison of the Effects of Esmolol and Dexmedetomidine on the Clinical Course and Cost for Controlled Hypotensive Anaesthesia; Turk J Anaesth Reanim 2013; 41: 156-61
15. Tarek Shams, Nahla S El Bahnasawe, Mohamed Abu Samra, Ragaa El Masry. Induced hypotension for functional endoscopic sinus surgery: A comparative study of dexmedetomidine versus esmolol; Saudi Journal of Anaesthesia Vol. 7, Issue 2, April-June 2013