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

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ABSTRACT

BACKGROUND

Functional Endoscopic Sinus Surgery (FESS) is a procedure for surgical management for chronic sinusitis. To achieve this, Hypotensive anaesthesia is widely used. We wanted to evaluate the safety and efficacy of dexmedetomidine as a hypotensive agent in comparison with clonidine in FESS.

METHODS

This randomized, double blind, prospective controlled study was done in a tertiary care hospital in Telangana. Sixty ASA physical status I and II patients (20-50 years) undergoing FESS were randomly allocated to one of the two groups. Group C, patients received 3 µg/Kg of clonidine diluted in 10 ml 0.9% normal saline infused over 10 minutes before induction of anaesthesia intravenously, followed by continuous infusion of 0.4-0.8 µg/Kg/hr. In group D, patients received loading dose of 1 µg/Kg Dexmedetomidine diluted in 10 ml 0.9% normal saline infused over 10 minutes before induction of anaesthesia, followed by continuous infusion of 0.4-0.8 µg/Kg/hr.

RESULTS

Target MAP was easily achieved in both groups and in Dexmedetomidine it was still lower compared to clonidine group. The MAP was successfully reduced to the target value (55-65 mmHg) in both groups, but MAP at incision was comparable in both groups and after 15 minutes was significantly lower in Group D (60.67 ± 5.9) when compared with Group C (65.63 ± 6.9), with a p-value <0.005. No patient in any of the two groups required additional therapy to achieve target MAP. Significant reduction in intra-operative blood loss, better surgical site scoring (1 or 2), and good analgesia and sedation were seen in both groups. Hence both drugs can be used for achieving hypotension, but Dexmedetomidine was more effective, safe and required in low doses compared to clonidine.

CONCLUSIONS

Both dexmedetomidine and clonidine provide good hemodynamic stability and safe operative field visibility, decreased blood loss; but, dexmedetomidine provides an additional benefit of reducing the analgesic requirements and provides significant postoperative sedation compared to clonidine.

KEYWORDS

Clonidine, Dexmedetomidine, Endoscopic surgery, Hypotension, Sinusitis.

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BACKGROUND

FESS (functional endoscopic sinus surgery) is a surgical treatment of long-standing sinus infections. Surgeon uses endoscopy in the nose to view the sinuses and do surgery. The important problem involved in surgery is small space and continuous bleeding from sinuses as the sinuses have rich supply of blood. The sinuses are surrounded by important organs like eyes and brain, so good surgical skill is utmost important to the surgeon for success in doing FESS surgery. Various methods have been used to improve the surgical field, such as patient positioning in reverse Trendelenburg, decongesting the nose, infiltrating the lateral nasal wall with lidocaine and epinephrine, or using the hypotensive anaesthesia technique.[1] Hypotensive anaesthesia is used to control blood pressure thereby reducing blood flow to surgical area and in turn reducing blood loss. And it will improve surgical field. FESS is better to be performed under controlled hypotensive technique (mean arterial pressure (MAP) between 60 and 70 mmHg); this can improve surgical field and decrease the operation time.[2] However, lowering the blood pressure carries its own risks including insufficient blood flow to the brain, hypoxia, delayed awakening, permanent brain damage and death. Several medications have been used to provide controlled hypotension such as inhalational volatile agents, Alpha 2 agonists (clonidine and dexmedetomidine), remifentanil, esmolol, nitroglycerin, intravenous lidocaine and magnesium sulfate.[3]

Alpha 2 agonists have potentially favorable effects like hypotension, analgesia and sedation and also show hemodynamic stability due to their central sympatholytic actions. They are valuable because of their analgesic and anaesthetic –sparing effects. Clonidine and more recently Dexmedetomidine have been used in anaesthetic practice to achieve controlled hypotension.[4] Our study is undertaken to evaluate the safety and efficacy of Dexmedetomidine as a hypotensive agent in comparison to clonidine in Functional Endoscopic Sinus Surgery (FESS) with attention on heart rate, MAP, the amount of blood loss, quality of the surgical field, sedation and analgesia in adult patients.

METHODS

This study was a prospective randomized double-blind controlled study conducted from January 2019 to December 2019 at the department of anaesthesia, Mamata medical college and General Hospital, Khammam, Telangana. After obtaining approval from hospital ethics committee 60 patients aged between 20-50 years, weighted 55-85 kg, ASA physical status I & II, scheduled for elective FESS were included in this study. Informed written consent was taken from participants in the study. Exclusion criteria included patients with recurrent sinus surgery, anaemia (haemoglobin concentration <10 gm/dl), patients with coagulopathies or receiving drugs influencing blood coagulation, systemic hypertension, significant cardiovascular diseases, renal diseases, diabetes mellitus, and hepatic diseases.

The patients were divided into two groups randomly by envelop method where Group C received Clonidine and group D received Dexmedetomidine. The patients were pre -medicated with midazolam (0.2 mg/Kg) and ondansetron (0.1 mg/Kg), glycopyrrolate (0.1 mg/Kg) an hour prior to induction of anaesthesia. In the operating room, two cannulae were inserted, one for infusion of Dexmedetomidine or clonidine and the other for administration of fluids and other drugs. In group C, patients received 3 µg/Kg of clonidine diluted in 10 ml 0.9% normal saline infused over 10 minutes before induction of anaesthesia intravenously followed by continuous infusion of 0.4-0.8 µg/Kg/hr. In group D, patients received loading dose of 1 µg/Kg dexmedetomidine diluted in 10 ml 0.9% normal saline infused over 10 minutes before induction of anaesthesia, followed by continuous infusion of 0.4-0.8 µg/Kg/hr. after pre-oxygenation with 100% oxygen, patients were premedicated with fentanyl (1 µg/Kg) and induced with 2 mg/Kg of propofol in titrated doses followed by vecuronium 0.8 mg/Kg to facilitate endotracheal intubation. The oropharynx was packed with a saline soaked throat pack. Anaesthesia was maintained with O_2/N_2O (50:50), isoflurane and fentanyl. All patients were given a 15° reverse Trendelenburg position to improve the venous drainage. If there was sinus bradycardia of <50 beats/min, it was treated with atropine (0.02 mg/Kg) IV, and if MAP was <55 mmHg, the inspired isoflurane concentration was reduced by 0.5%, till MAC reached 0.75. If hypotension persisted, ephedrine 3 mg in incremental dosage was administered. At the end of the procedure, the anaesthetic agent discontinued, reversal agent (Neostigmine+ Glycopyrrolate) given and throat pack was removed. The patients were extubated when awake and were monitored in recovery room.

Vital parameters namely, Blood Pressure, pulse rate, respiratory rate and oxygen saturation were monitored and measured at 5 min interval from the time of intervention till discharge to the ward. Sedation and pain scores were measured in recovery room. Blood loss was estimated by measuring the volume in the suction bottle and the number of swabs soaked in blood accounting for any saline flush use during the procedure. The surgeons graded the surgical field at the end of the procedure using Fromme–Boezaart scale.[5] Clear surgery field with no suctioning required was defined as 'bloodless' field. An average category scale for assessment of the intraoperative surgical field was used:

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 threatened surgical field a few Seconds after suction was removed.
4- Moderate bleeding; frequent suctioning required; bleeding threatened surgical field Directly after suction was removed.

5- Severe bleeding; constant suctioning required bleeding appeared faster than could be removed by suction surgical field severely threatened and surgery not possible.

The postoperative sedation was assessed with Ramsay Sedation Score.[6] The postoperative side-effects such as nausea and vomiting, shivering and dry mouth were observed and recorded.

RESULTS

The mean age in group C was 36.10 ± 10.90 and in group D was 35.92 ± 11.58, which is statistically not significant (p >0.05) (Table 1). The number of male and female patients in Group C was 18 and 12 respectively and in Group D this was 19 and 11 respectively, which is statistically not significant (p >0.05). The most common pre-operative diagnosis in both the groups was chronic sinusitis and nasal polyposis.

	Group C	Group D	p
Age (years)	36.10 ± 10.90	35.92 ± 11.58	0.89
Height (cm.)	151.02 ±4.73	149.56 ± 4.63	0.87
Weight (kg.)	55.11 ± 3.54	54.52 ± 3.54	0.92
ASA grade I/II	18/12	17/13	0.78
Male/Female	18/12	19/11	0.98

Table 1. Demographic Data

The mean HR at pre-operative, After drug infusion, at time of incision and after 5 minutes, 10 minutes, 20 minutes, 30 minutes, 40 minutes, 50 minutes, 60 minutes, 70 minutes, 80 minutes, 90 minutes, 100 minutes, 110 minutes and 120 minutes was significantly lower in Group D compared with Group C ($p < 0.05$), as seen in Figure 1.

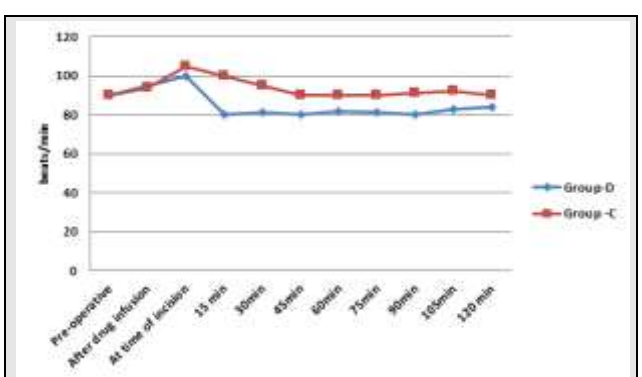

Figure 1. Comparison of Heart Rate in Both Groups

The mean arterial pressure was successfully reduced to the target value (55-65 mmHg)in both groups, but MAP at incision was comparable in both groups and after 15 minutes was significantly lower in Group D (60.67 ± 5.9) when compared with Group C (65.63 ± 6.9), with a p-value < 0.005. Intraoperatively also at 60 minutes, 70 minutes, 80 minutes, 100 minutes, 110 minutes and 120 minutes MAP was significantly lower in Group D as compared with Group C as shown in Figure 2. No Patient in any of the two groups required additional therapy to achieve target MAP.

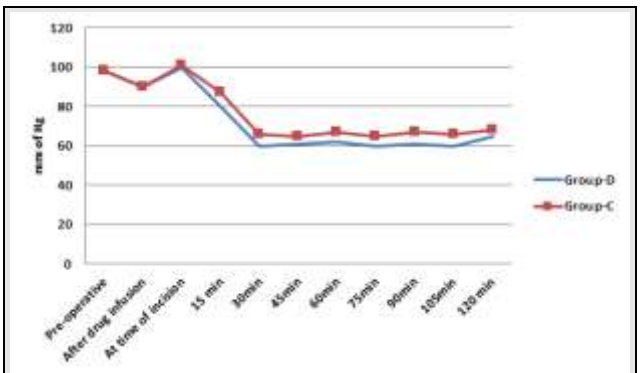

Figure 2. Comparison of Mean Arterial Pressure in Both Groups

There is no significant difference between two groups regarding the total duration of surgery and hypotensive period. There was significant decrease in blood loss in two groups, but it was comparable in both groups. The amount of blood loss in Group C was 168.82+11.23 ml and in Group D it was 160.15+12.23 ml (p>0.05). The Fromme–Boezaart scale of blood loss was shown in table 2.

Scale	Group C (No. of Patients)	Group D (No. of Patients)
0	0	0
1	10	14
2	19	16
3	1	0
4	0	0
5	0	0

Table 2. Blood Loss and Surgical Site Scoring Using Fromme–Boezaart Scale

The Ramsay Sedation Scores were significantly higher in group D compared with group C with majority of patients having a sedation score of 3 (46%) in group D while most of the patients had a score of 2 in group C. The time to first analgesic request was significantly prolonged in group D (122.23 ± 0.52 min) when compared to clonidine (98.05±0.43 min). No post-operative complications were seen in either of the two groups.

DISCUSSION

An important technique to reduce bleeding during the surgery is controlled reduction in blood pressure to such levels so that bleeding is minimal, but at the same time perfusion to the vital organs is well maintained. This is the underlying concept for controlled hypotensive anaesthesia.[7] Excessive blood in the field of operation obscures visibility and may lead to complications during functional endoscopic sinus surgery (FESS).[8] Hence, an almost bloodless surgery would provide the surgeon with a clear field minimizing the risk of injury to vital structures, minimizing the intra-operative blood loss and the surgical time.[9] In our study we compared the both α2 adrenoceptor agonists Dexmedetomidine and clonidine in achieving the targeted hypotension. When compared to clonidine, Dexmedetomidine is highly selective to alpha-2 receptors (1620:1 vs 220:1). Hence dexmedetomidine is more potent than clonidine in their pharmacological actions.[10] Both drugs in our study lowered the heart rate. Dexmedetomidine

caused a lower heart rate due to its sympatholytic effect.[11] The bradycardia due to clonidine is by its central action on lowering sympathetic tone and raising para sympathetic tone and also its action on baroreceptor afferent neurons.[12] The mean arterial pressure was successfully reduced to the target value (55-65 mmHg) in both groups, but MAP at incision was comparable in both groups and after 15 minutes was significantly lower in Group D (60.67±5.9) when compared with Group C (65.63±6.9), with a p-value <0.005. Dexmedetomidine is more selective alpha 2 agonist, and it causes hypotension, bradycardia, sedation and analgesia. The fall in blood pressure is mainly due to inhibition of central sympathetic outflow and also due to stimulation of presynaptic α2 adrenoceptors decreasing norepinephrine release.[13] Another important advantage of DEX when compared to opioids is less respiratory depressant and more sedative. Many studies have shown that Dexmedetomidine decreases the bleeding in surgeries within the framework of hemodynamic stability.[14,15]

As clonidine show reduction in central sympathetic flow by acting on central alpha 2 adrenergic receptors it is used as anaesthesia adjuvant in many anaesthesia procedures. Besides its antihypertensive effect, it also diminishes requirements for inhaled anaesthetics and enhances the effects of sedative, anxiolytic, and analgesic drugs,[16] decreases pressor response to laryngoscopy and intubation,[17] postoperative nausea, vomiting and shivering.[18] In our study, significant fall in mean HR, and MAP was observed in patients receiving clonidine. These findings were similar to the findings of other studies,[19,20] The MAP also showed a significant reduction in group D compared to group C. This observation suggested that dexmedetomidine is effective in blunting the hemodynamic response of stress during laryngoscopy as has been shown by other studies.[21] Clonidine reduces blood pressure by reducing release of nor epinephrine from central and peripheral nerve endings by interacting with catecholamine mediated neuronal pathway.[22]

The blood loss during surgery was significantly reduced in both groups. Blood loss and surgical site scoring using Fromme–Boezaart scale was 1or 2 in both groups. The MAP however, was equally lowered in both groups suggesting equal efficacy of two drugs in lowering the MAP, thereby providing comparable surgical field as suggested by the Fromme and Boezaart's score. It may be due to hemodynamic attenuation with both drugs, as diminished sympathetic outflow results from central α2 adrenoceptor stimulation thus reducing bleeding.[23] The analgesic efficacy of dexmedetomidine has been appreciated in diverse settings.[24] Similarly, we found that intra-operative analgesic requirement was significantly reduced in the dexmedetomidine group as compared to the clonidine group. The patients in the dexmedetomidine group had significantly higher sedation scores compared to group C. The sedative and analgesic sparing effects of dexmedetomidine are mediated through its action in the locus coeruleus and dorsal horn of spinal cord respectively.[25]

CONCLUSIONS

Both dexmedetomidine and clonidine provide good hemodynamic stability and safe operative field visibility, decreased blood loss; but, dexmedetomidine provides an additional benefit of reducing the analgesic requirements and provides significant postoperative sedation compared to clonidine.

REFERENCES

[1] Yoo HS, Han JH, Park SW, et al. Comparison of surgical condition in endoscopic sinus surgery using remifentanil combined with propofol, sevoflurane, or desflurane. Korean J anaesthesiol 2010;59(6):377-382.

[2] Marzban S, Haddadi S, Nia HM, et al. Comparison of surgical conditions during propofol or isoflurane anaesthesia for endoscopic sinus surgery. anaesth Pain Med 2013;3(2):234-238.

[3] Hamed MA. Comparative study between magnesium sulfate and lidocaine for controlled hypotension during functional endoscopic sinus surgery: a randomized controlled study. anaesth Essays Res 2018;12(3):715-718.

[4] Maze M, Tranquilli W. Alpha-2 adrenoceptor agonists: defining the role in clinical anaesthesia. anaesthesiology 1991;74(3):581-605.

[5] Kelly EA, Gollapudy S, Poetkar DM, et al. Quality of surgical field during endoscopic sinus surgery: a systemic literature review of the effect of total intravenous compared to inhalational anaesthesia. Int Forum Allergy Rhinol 2013;3(6):474-481.

[6] De Jonghe B, Cook D, Appere-De-Vecchi C, et al. Using and understanding sedation scoring systems: a systematic review. Intensive Care Med 2000;26(3):275-285.

[7] Tobias JD. Controlled hypotension in children: a critical review of available agents. Paediatr Drugs 2002;4(7):439-453.

[8] Stankiewicz JA. Complications of endoscopic intranasal ethmoidectomy. Laryngoscope 1987;97(11):1270-1273.

[9] Mandal P. Isoflurane anaesthesia for functional endoscopic sinus surgery. Indian J Anaesth 2003;47(1):37-40.

[10] Gertler R, Brown HC, Mitchell DH, et al. Dexmedetomidine: a novel sedative-analgesic agent. Proc (Bayl Univ Med Cent) 2001;14(1):13-21.

[11] Basar H, Akpinar S, Doganci N, et al. The effects of preanesthetic, single-dose dexmedetomidine on induction, hemodynamic, and cardiovascular parameters. J Clin anaesth 2008;20(6):431-436.

[12] Kumar A, Bose S, Bhattacharya A, et al. Oral clonidine premedication for elderly patients undergoing intraocular surgery. Acta Anaesthesiol Scand 1992;36(2):159-164.

[13] Hall JE, Uhrich TD, Barney JA, et al. Sedative, amnestic, and analgesic properties of small-dose dexmedetomidine infusions. anaesth Analg 2000;90(3):699-705.
[14] Turan G, Dincer E, Ozgultekin A, et al. Comparison of dexmedetomidine, remifentanyl and esmolol in controlled hypotensive anaesthesia. Eur J Anaesthesiol 2008;25:65-66.
[15] Erbesler ZA, Bakan N, Karaoren GY, et al. A comparison of the effects of esmolol and dexmedetomidine on the clinical course and cost for controlled hypotensive anaesthesia. Turk J Anaesthesiol Reanim 2013;41(5):156-161.
[16] Bloor BC, Flacke WE. Reduction in halothane anaesthetic requirement by clonidine, an alpha-adrenergic agonist. anaesth Analg 1982;61(9):741-745.
[17] Mikawa K, Nishina K, Maekawa N, et al. Attenuation of the catecholamine response to tracheal intubation with oral clonidine in children. Can J Anaesth 1995;42(10):869-974.
[18] Handa F, Fujii Y. The efficacy of oral clonidine premedication in the prevention of postoperative vomiting in children following strabismus surgery. Paediatr Anaesth 2001;11(1):71-74.
[19] Nishina K, Mikawa K, Maekawa N, et al. The efficacy of clonidine for reducing perioperative haemodynamic changes and volatile anaesthetic requirements in children. Acta Anaesthesiol Scand 1996;40(6):746-751.
[20] El-Kerdawy HM, Zalingen EE, Bovill JG. The influence of the alpha2-adrenoceptor agonist, clonidine, on the EEG and on the MAC of isoflurane. Eur J Anaesthesiol 2000;17(2):105-110.
[21] Huncke TK, Adelman M, Jacobowitz G, et al. A prospective, randomized, placebo-controlled study evaluating the efficacy of dexmedetomidine for sedation during vascular procedures. Vasc Endovascular Surg 2010;44(4):257-261.
[22] Raval DL, Mehta MK. Oral clonidine pre-medication in attenuation of haemodynamic response to laryngoscopy and intubation. Indian J Anaesth 2002;46(2):124-129.
[23] Jabalameli M, Hashemi SM, Soltani HA, et al. Oral clonidine premedication decreases intra operative bleeding in patients undergoing endoscopic sinus surgery. J Res Med Sci 2005;10:25-30.
[24] Karaaslan K, Yilmaz F, Gulcu N, et al. Comparison of dexmedetomidine and midazolam for monitored anaesthesia care combined with tramadol via patient controlled analgesia in endoscopic nasal surgery: a prospective, randomized, double-blind, clinical study. Curr Ther Res Clin Exp 2007;68(2):69-81.
[25] Guo TZ, Jiang JY, Buttermann AE, et al. Dexmedetomidine injection into the locus ceruleus produces anti-nociception. anaesthesiology 1996;84(4):873-881.