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EFFECTIVENESS OF DEXMEDETOMIDINE IN REDUCING BLEEDING AND PROVIDING CLEAR SURGICAL FIELD DURING TYMPANOPLASTY OPERATIONS UNDER GENERAL ANESTHESIA

ABSTRACT

Aims and Objective :
The present study was aimed to evaluate the clinical effects of dexmedetomidine infusion as anaesthetic adjuvant during middle ear microsurgery.

Material s and Methods:
Eighty adult patients aged 20-60 years with American Society of Anesthesiologists Grades I and II, of both gender were randomized into two comparable equal groups of 40 patients each for middle ear micro surgery under general anesthesia with standard anesthetic technique. After induction of general anesthesia, patients of Group I (DX group) were given dexmedetomidine infusion of 0.5 μg/kg/h and patients of Group II (NS group) were given infusion of normal saline. Isoflurane concentration was titrated to achieve a systolic blood pressure30% below the baseline value. All patients were assessed intra-operatively for bleeding at surgical field, haemodynamic changes and post-operative recovery.

Results:
Patients receiving dexmedetomidine infusion had statistically significant lesser bleeding at surgical field ($P < 0.05$).The mean awakening time and recovery from anaesthesia did not show any significant difference between the groups.

Conclusion:
Dexmedetomidine infusion can be safely used to decrease intra-operative bleeding for better visualization during middle ear microsurgery.

Key Words : Dexmedetomidine, middle ear microsurgery, Clear bloodless surgical field, General anesthesia.

INTRODUCTION

Tympanoplasty involves reconstruction of perforated tympanic membrane with or without ossiculoplasty.[1] It is usually done under local anesthesia with sedation under monitored anesthesia care (MAC) or general anesthesia. [2–4] Patients may feel discomfort due to pain, noise due to suction, manipulation of instruments and head-neck position under local anesthesia. Hence to avoid these problems we decided to conduct our study under general anaesthesia.

Middle ear micro surgery under general anesthesia is revolutionized with the introduction of hypotensive anesthesia that provides a relatively bloodless field. The primary methods to minimize blood loss during middle ear surgery included mild head elevation of 15°, and infiltration or topical application of epinephrine (1: 50,000 or 1: 200,000). Currently, many inhalational or intravenous anesthesia techniques were used to offer ideal intra-operative conditions for middle ear surgery with their advantages and disadvantages. Numerous pharmacological agents effectively lower the systemic blood pressure for hypotensive anesthesia. Nitroglycerine & Sodium nitroprusside precisely control the blood pressure due to their rapid onset and short duration of action, but intra-arterial blood pressure monitoring and electrocardiogram (ECG) with S-T segment analysis are mandatory. Dexmedetomidine, a potent selective B2-adrenoceptor agonist, is used as adjuvant to general anesthesia during surgery. Pre-operatively for sedation, intra-operatively for analgesia and hemodynamic stability. It is valuable because of its anesthetic and analgesic-sparing effects with predictable and dose-dependent hemodynamic effects with no respiratory depression.[5,6,7] The present prospective double blind randomized control study was aimed to evaluate the effects of dexmedetomidine infusion on the requirement of isoflurane concentration to lower systolic blood pressure below 30% of baseline values, quality of clear bloodless surgical field, and awakening time in patients undergoing middle ear microsurgery

MATERIALS AND METHODS

After approval from our institutional Ethical Committee and written informed consent, 80 adult patients of American Society of Anesthesiologists (ASA) physical status I and II of both genders,

aged 20-60 years, weighing 40-60 kg, scheduled for elective middle ear micro surgery, were enrolled for this prospective double-blind controlled randomized study. Exclusion criteria were presence of cardiac or respiratory disease, hypertension, obesity (body mass index > 26 kg/m2), hepatic or renal dysfunction, bleeding or coagulation disorders. Patients with a history of anticipated difficult airway, those on sedatives, hypnotics or antihypertensive medication or allergy to any anaesthetic medications were also excluded from the study. The patients were randomly divided into two equal groups, Group I (dexmedetomidine) and Group II (Normal saline) on basis of a computer-generated randomization scheme. The anesthesiologist conducting the case, the patients and the anesthesiologist in the post anesthesia care unit (PACU) were all blinded to group assignment. Data was recorded by a blinded observer and the drugs were prepared by an anesthesiologist who did not participate in patient management or data collection. Two 50-ml syringes, labeled as loading and maintenance were given for each patient. Patients of Group I(DX group) received infusion of dexmedetomidine 0.5 μg/kg/h and patients of Group II(NS group) received infusion of normal saline during middle ear surgery after induction of anaesthesia till 20 min before completion of surgery. All patients were admitted prior to the day of the surgery, and fasting of 6 hr was ensured. On arrival to the operation theatre, the baseline systemic blood pressure, heart rate, oxygen saturation (SpO2) and ECG were recorded. After establishing the intravenous line, lactate Ringer solution was started and they were pre-medicated with ondansetron (4μg), glycopyrrolate (0.2 mg),midazolam (o.2 mg/kg) and fentanyl (1 μg/kg), 15 min before induction of anaesthesia. After pre-oxygenation for 3 min, anesthesia was induced with propofol (2 mg/kg) till loss of verbal command and tracheal intubation was facilitated with Succinyl scoline (2mg/kg). Anesthesia was maintained with 60% nitrous oxide in oxygen with isoflurone and vecuronium(0.1 mg/kg) as muscle relaxant. Patients were mechanically ventilated to maintain the end-tidal concentration (EtCO2) between 30 and 35 mm Hg. Intra-operatively, the heart rate, non invasive blood pressure, ECG, EtCO2 and oxygen saturation (SpO2)were monitored and recorded at 5 min intervals till end of surgery. During procedure the bleeding at surgical site was assessed by the surgeon as Grade 0-no bleeding-excellent surgical conditions; Grade I-minimum bleeding, sporadic suction needed; Grade II-diffuse bleeding, repeated suction needed; and Grade III-considerable, troublesome bleeding, and continuous suction was needed. After surgery, the residual neuromuscular blockade was reversed with neostigmine (0.05 mg/kg) and glycopyrrolate (0.008 mg/kg). Patients were extubated after observing adequate motor recovery and spontaneous breathing efforts. Awakening time following reversal of neuromuscular blockade was recorded. This duration of awakening time comprised from administration of reversal of neuromuscular blockade till sustained eye opening on command. Patients were transferred to post-anesthesia care unit for observation of any respiratory depression, hemodynamic changes, nausea/vomiting or any other drug-induced side-effects or complications. The recorded data were tabulated and expressed in mean ± standard deviation. Statistical analysis was performed using Microsoft Excel. Statistical significance in time related variables were analyzed using Student's t-test. $P < 0.05$ was considered as statistically significant.

RESULTS

The present study evaluated the clinical effects of dexmedetomidine infusion during middle ear micro surgery under general anesthesia. It was successfully completed on 80 adult patients, and all patients were included in the data analysis. The demographic data of age, sex, weight, ASA physical status and duration of surgery were comparable between the groups . The baseline values of mean heart rate and systolic blood pressure were comparable between the groups with no statistical significance. After intubation and throughout intraoperative eriod till extubation heart rate and mean arterial lood pressure were maintained normally ,p value <0.05 (Table1&2) in group 1(DX group) only and that is essential to provide clear bloodless field during microscopic ear surgery. The mean heart rate and MAP were found to be higher in patients of Group II(NS group) after the extubation while patients of Group I(DX group) did not show much variation in their mean heart rate values. The required percentage of isoflurane concentration was significantly less ($P < 0.05$) to maintain the mean systolic blood pressure 30% below baseline values in patients of Group I (DX group) who received intra-operative dexmedetomidine infusion.

The operating microscope was used throughout the middle ear surgery and surgeons observed

Grade I bleeding (minimum bleeding with sporadic suction) at surgical site in majority of patients of Group I and none of the patients had bleeding of Grade III [Table 3]. None of the patients of Group II had significant reduction in bleeding at surgical site, thus it is evident that patients receiving dexmedetomidine infusion had a better surgical field as compared to patient of Group II ($P < 0.05$). The difference in bleeding at surgical site was statistically significant between the groups. All patients were able to obey the commands, and the duration of awakening time and recovery were comparable between the groups. Post-operative respiratory rate and oxygen saturation were comparable with no episode of desaturation at any time. No side effect of dexmedetomidine infusion was observed during the study period.

TABLE 1: Comparison of Heart Rate values between the groups (beats /min) (Mean±SD)

Heart Rate (Beats/Min)	Group 1 (DX group)	Group 2 (NS group)	P value
Base line	81.64±12.63	79.84±8.90	0.4635
After induction	70.48±10.51	71.80±9.51	0.5576
After intubation	70.88±9.04	78.80±12.04	0.0013
At 5 min	65.96±8.79	70.68±13.14	0.0627
At 30 min	59.12±7.17	68.36±7.91	less than 0.0001
At 60 min	57.68±6.56	66.25±9.05	less than 0.0001
After extubation	60.17±6.52	68.17±7.41	less than 0.0001

TABLE 2: Comparison of Mean Arterial Pressure values between the groups (mmHg) (M

MAP (mmHg)	Group 1(DX group)	Group 2(NS group)	P value
Base line	97.48±12.14	95.64±8.98	0.4432
After induction	83.92±14.48	77.20±12.76	0.0306
After intubation	80.84±12.59	85.48±15.25	0.1419
At 5 min	67.28±6.76	74.52±8.96	0.0001
At 30 min	60.68±3.33	70.60±3.27	less than 0.0001
At 60 min	61.18±3.18	72.04±6.64	less than 0.0001
After extubation	60.94±3.13	76.76±2.82	less than 0.0001

TABLE 3: Assessment of intra-operative bleeding by surgeon

Grades	Suction Requirement	Group 1 (DX group)	Group 2 (NS group)
0:No bleeding	No suction	0	0
i: Minimum bleeding	Sporadic suction	35	3
ii:Diffuse bleeding	Repeated suction	5	30
iii:Trouble bleeding	Continuous suction	0	7

DISCUSSION :

Middle ear surgeries require good surgical field visibility with no post-operative nausea and vomiting. In the present study, the dexmedetomidine infusion was used to decrease bleeding during middle ear micro surgery. It is evident from the study that the patient receiving dexmedetomidine infusion has decreased bleeding and better visibility when compared to patient receiving normal saline. These findings can be attributed to the fact that dexmedetomidine reduces sympathetic activity, resulting in lower blood pressure and reduced heart rate thereby decreasing blood loss at the surgical site to improve the quality of the surgical field. Dexmedetomidine is a highly selective B2 adrenergic agonist and used as adjuvant in anesthesia to reduce the intra-operative anesthetic and analgesic requirement. It regulates the autonomic and cardiovascular systems by acting on blood vessels and inhibiting norepinephrine release at sympathetic terminals, there by attenuating the heart rate and blood pressure responses to intra-operative stressful events of anesthesia. It effectively minimizes the surgical blood loss and improves the surgical field visibility. Its haemodynamic effects are predictable and dose-dependent.[8-10] Currently, many inhalational or intravenous anesthesia techniques were evaluated to offer ideal intra-operative conditions for middle ear surgery. Jellish et al judged that the intravenous anesthesia technique provided better hemodynamic control, less movement, and faster emergence during middle ear surgery.[1]

Short acting inhalational anesthetics such as desflurane and isoflurane produced excellent operating conditions for otological surgery.[11-13] Even small amount of blood can obscure the microscopic operating field and decreasing the extravasation of blood may improve the results of surgical procedures. Different techniques, to

minimize intra-operative blood loss during middle ear surgery are used. The conventional techniques of electively lowering the blood pressure are positive pressure ventilation and administration of hypotensive drugs. In the study of Bekker et al., patients received an initial loading dose of 1 μg/kg of dexmedetomidine over 10 min, followed by a continuous infusion of 0.5 μg/kg/h and they determined that intra-operative dexmedetomidine infusion was effective for blunting the perioperative haemodynamic responses with no incidence of hypotension or bradycardia.[14] In a study by Kumkum et al, dexmedetonidine infusion was safe to provide oligaemic surgical field for better visualization under operating microscope for middle ear surgery keeping the hemodynamic variations within the physiological range. Our present study was in accordance with their study as all patients were haemodynamically stable, and none of them required vasopressor support or bolus administration of fluid to maintain haemodynamic status. In our study, no patients suffered from bradycardia as dexmedetomidine infusion was given in dose of 0.5 μg/kg/h and loading dose of dexmedetomidine was not given. The result of the present study indicates that the use of dexmedetomidine infusion reduced the percentage of isoflurane concentration to maintain a systolic blood pressure 30% below baseline values. These findings confirm with a previous study of Khan et al. which also showed that use of dexmedetomidine reduces the requirement of inhalational anesthetic.[15] Dexmedetomidine was well tolerated, and none of the patients developed any drug-related side-effects or complications in the perioperative period. The dexmedetomidine infusion did not affect the awakening time or delay the recovery from anaesthesia. Guler et al. found that the increase in blood pressure and heart rate during extubation is decreased, and the quality of extubation is improved by dexmedetomidine.[16] Our findings were in accordance to their study. In our study, none of the patients suffered from respiratory depression as we did not use dexmedetomidine in high doses.[17] Also Prophylaxis with ondansetron in premedication was considered for the present study and none of the patients suffered from post-operative nausea and vomiting.

CONCLUSION :

Dexmedetomidine infusion is safe to provide decrease bleeding for good surgical field and better visualization for middle ear micro surgery under general anesthesia keeping the hemodynamic variations within the physiological range.

REFERENCES :

1. Jellish WS, Owen K, Edelstein S, Fluder E, Leonetti JP. Standard anesthetic technique for middle ear surgical procedures: A comparison of desflurane and sevoflurane. Otolaryngol Head Neck Surg 2005;133:269-74.
2. Marchal JM, Gómez-Luque A, Martos-Crespo F, SánchezDe La Cuesta F, Martínez-López MC, Delgado-Martinez AD.Clonidine decreases intraoperative bleeding in middle ear microsurgery. ActaAnaesthesiolScand 2001;45:627-33.
3. Firat Y, Kizilay A, Akarcay M, Yucel A, But K, Yologlu S. The effect of dexmedetomidine on middle ear pressure. Otolaryngol Head Neck Surg 2007;137:218-23.
4. Liang S, Irwin MG. Review of anesthesia for middle ear surgery. Anesthesiol Clin 2010;28:519-28.
5. Nasreen F, Bano S, Khan RM, Hasan SA. Dexmedetomidine used to provide hypotensive anesthesia during middle ear surgery. Indian J Otolaryngol Head Neck Surg 2009;61:205-7.
6. Turan G, Ozgultekin A, Turan C, Dincer E, YukselG. Advantageous effects of dexmedetomidine on haemodynamicandrecoveryresponsesduringextubationfor intracranial surgery. Eur J Anaesthesiol 2008;25:816-20.
7. Ayoglu H, Yapakci O, Ugur MB, Uzeen L, Altunkaya H, OzerY,et al. Effectiveness of dexmedetomidine in reducing bleeding during septoplasty and tympanoplasty operations. J ClinAnaesth 2006;53:646-52.
8. Sudheesh K, Harsoor S. Dexmedetomidine in anaesthesia practice: A wonder drug? Indian J Anaesth 2011;55:323-4.
9. Patel A, Davidson M, Tran MC, Quraishi H, Schoenberg C,Sant M, et al. Dexmedetomidine infusion for analgesia and prevention of emergence agitation in children with obstructive sleep apnea syndrome undergoing tonsillectomy and adenoidectomy. AnesthAnalg 2010;111: 1004-10.
10. Hall JE, Uhrich TD, Barney JA, Arain SR, Ebert TJ.Sedative, amnestic, and analgesic properties of small-dosedexmedetomidine infusions. AnesthAnalg 2000;90:699-705.
11. Lee YY, Wong SM, Hung CT. Dexmedetomidine infusion as asupplement to isoflurane anaesthesia for vitreoretinal surgery.Br J Anaesth 2007;98:477-83.
12. Tanskanen PE, Kyttä JV, Randell TT, Aantaa RE.Dexmedetomidine as an anaesthetic adjuvant in patients undergoing intracranial tumour surgery: A double-blind,randomized and placebo controlled study. Br J Anaesth2006;97:658-65.
13. Yildiz M, Tavlan A, Tuncer S, Reisli R, Yosunkaya A,Otelcioglu S. Effect of dexmedetomidine on haemodynamic responses to laryngoscopy and intubation: Perioperative haemodynamics and anaesthetic requirements. Drugs R D2006;7:43-52.
14. Bekker A, Sturaitis M, Bloom M, Moric M, Golfinos J, Parker E,et al. The effect of dexmedetomidine on perioperative hemodynamics in patients undergoing craniotomy. AnesthAnalg 2008;107: 1340-7.
15. Khan ZP, Munday IT, Jones RM, Thornton C, Mant TG, Amin D. Effects of dexmedetomidine on isoflurane requirements in healthy volunteers 1: Pharmacodynamic and pharmacokinetic interactions. Br J Anaesth 1999;83: 372-80.
16 Guler G, Akin A, Tosun Z, Eskitasoglu E. During the extubation,the effects of dexmedetomidine on cardiovascular changes and quality of extubation in the old patients undergoing cataract surgery. Turk J Anaesth 2005;33:18-23.
17. EbertTJ, HallJE, BarneyJA, UhrichTD, ColincoMD. Theeffects of increasing plasma concentrations of dexmedetomidine in humans. Anesthesiology 2000;93:382-94.