Research Article

Optimisation of intramuscular dosage of dexmedetomidine for hypotensive anesthesia in functional endoscopic sinus surgery- a prospective randomized double blind study

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Abstract

Background of the study: Dexmedetomidine, a selective alpha-2 agonist which is being used widely in anesthesia and critical care practice. It has both sedative and analgesic property. The studies on intravenous usage of dexmedetomidine are numerous but not with intramuscular route. With this background we conducted a study on optimisation of intramuscular dosage of dexmedetomidine in patients undergoing functional endoscopic sinus surgery. **Aim and objectives:**To optimize the dosage of intramuscular dexmedetomidine in patients undergoing functional endoscopic sinus surgery for providing bloodless field for the surgeon.**Materials and methods:** We enrolled a total of 50 patients who have planned to undergo functional endoscopic sinus surgery under general anesthesia. After randomization, group D1 patients received intramuscular dexmedetomidine at the dosage of 0.5mcg/kg and group D2 1mcg/kg respectively. Hemodynamic parameters like blood pressure (MAP) and heart rate were recorded at regular intervals. The surgical field score was done by the operating ENT surgeon using Boerzaart scale. The targeted mean arterial blood pressure was kept between 55-65mmHg. The other parameters like additional requirement of opioid, usage of other vasodilators, time to emergence along with other side effects were noted peri-operatively.**Results:**After statistical analysis, the mean duration of surgery in both groups were 92±21.8 and 85±22.15 minutes respectively. The targeted mean arterial blood pressure was achieved in the patients who have received 1mcg/kg of dexmedetomidine (Group D2) intramuscularly. The surgeon felt satisfied with bloodless operating field in the patients who received 1mcg/kg of dexmedetomidine. **Conclusion**: From our study we concluded that 1mcg/kg of dexmedetomidine will be the adequate intramuscular dose for both premedication and hypotensive agent in functional endoscopic sinus surgery.

Keywords: Dexmedetomidine, Alpha-2 agonist, Endoscopic Sinus Surgery.

Introduction

Functional endoscopic sinus surgery needs bloodless field for the operating surgeon[1]. Excessive bleeding can hinder surgical process with reduced intra-operative visualization.To reduce bleeding and improve visualization techniques like hypotensive anesthesia, elevation of the head end during surgery and administration of local vasoconstrictors are being followed by anesthesiologists[2]. Now a new novel sedative-analgesic agent, dexmedetomidine used for providing controlled hypotensive anesthesia in functional endoscopic sinus surgery apart from ICU sedation. Dexmedetomidine, a potent selective alpha-2 agonist has sedative, analgesic and anesthetic sparing effect and sympatholytic properties[3,4]. The central and peripheral sympatholytic action of dexmedetomidine is mediated by alpha-2 adrenergic receptor and causes dose dependent decrease in arterial blood pressure, heart rate, cardiac output and nor-epinephrine release. There are various studies on

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intravenous dexmedetomidine usage in various aspects of anesthesia and critical care with minimal reseach on intramuscular administration[5,6,7]. With this aspect we planned to conduct a study on intramuscular dosage optimization of dexmedetomidine in patients undergoing functional endoscopic sinus surgery.

Materials and Methods

After ethical committee approval (Ref.no.15 IEC No: 5/April 2015) Informed consent from the patient during pre-anaesthetic evaluation was obtained from 50 ASA PS-1 or PS-II patients. The study was conducted between June' 2015-January' 2016 in our department.

Inclusion criteria:
ASA-PS I and II patients planned for FESS.
Age: 18-60 years

Exclusion criteria:
Age <18 years and >60 years
Recurrent sinus surgery, AV BLOCK I & II
Hypertension, CAD, Renal or hepatic insufficiency, CVA, Patient with coagulopathies and on anti-coagulants. Computer generated randomization was done to receive dexmedetomidine (1mcg/kg) (n=25) Group D2 or dexmedetomidine (0.5mcg / kg)(n=25) Group D1 intramuscularly 15 minutes before induction of anesthesia by an Anesthesiologist (not involved in the study). The operating surgeon was blinded to our study. The routine general anesthesia was given. On table premedication was given with Inj.Midazolam 0.05mg/kg and fentanyl 2mcg/kg. Patient was induced with Inj. Propofol 2mg/kg and Atracurium 0.5mg/kg. And then intubation was done with appropriate sized endotracheal tube. Intra operatively anesthesia was maintained with sevoflurane 1-2% and intermittent bolus dose of fentanyl and atracurium, N2O:O2 was kept in the ratio of 2:1. Our targeted mean arterial blood was kept around 55-65mmHg. If this was not achieved NTG infusion was started. Inadequate anesthesia signs were treated with additional doses of fentanyl. Intra-operative fluid management was done according to 4-2-1 formula.

Surgical issues: The same surgeon was involved in our study to ensure consistency in the estimation of surgical field. Throat pack was kept. Adrenaline soaked infiltration was done to minimize the blood loss.

Estimation of blood loss:

- From the suction suction apparatus
- Quality of surgical field estimation by a pre-defined category scale by Boerzaart et.al.

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 is 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.

At the end of surgery, sevoflurane was stopped and throat pack was removed. The residual neuromuscular blockade was antagonized with neostigmine 0.05 mg/kg and glycopyrrolate 0.02 mg/kg.

Hemodynamics monitoring: Heart rate, Mean arterial blood pressure, Spo2 were recorded preoperatively (baseline) and then every 5 minutes intra-operatively until the end of surgery. Hypotension (MAP <55mmHg) was treated with fluid bolus followed by Inj. Ephedrine and bradycardia (HR <50) was with Inj. Atropine 0.3-0.6mg intravenously.

Monitored other parameters in our study: Intra-operative fentanyl consumption and requirements for additional hypotensive agent (NTG) wererecorded. Emergence time-interval between the discontinuation of anesthetics to the response of eye opening to verbal commands was also recorded. The patient was shifted to PACU for observation. In PACU the time to first rescue analgesia was noted.Sedation was assessed by Ramsay sedation score. If PADSS>9 patient was discharged from PACU to ward with a word of thanks to the patient.

Results

Statistical analysis was done using the SPSS statistical package (Graphpad software). Values were given asmean±SD. A p value < 0.05 was considered significantly significant.

Demographic Profile: The demographic profile of both study group was comparable with respect to age,weight, sex and ASA physical status. The mean duration of surgery was 92±21.8and 85±22.15 minutesin group D1 and group D2 respectively.

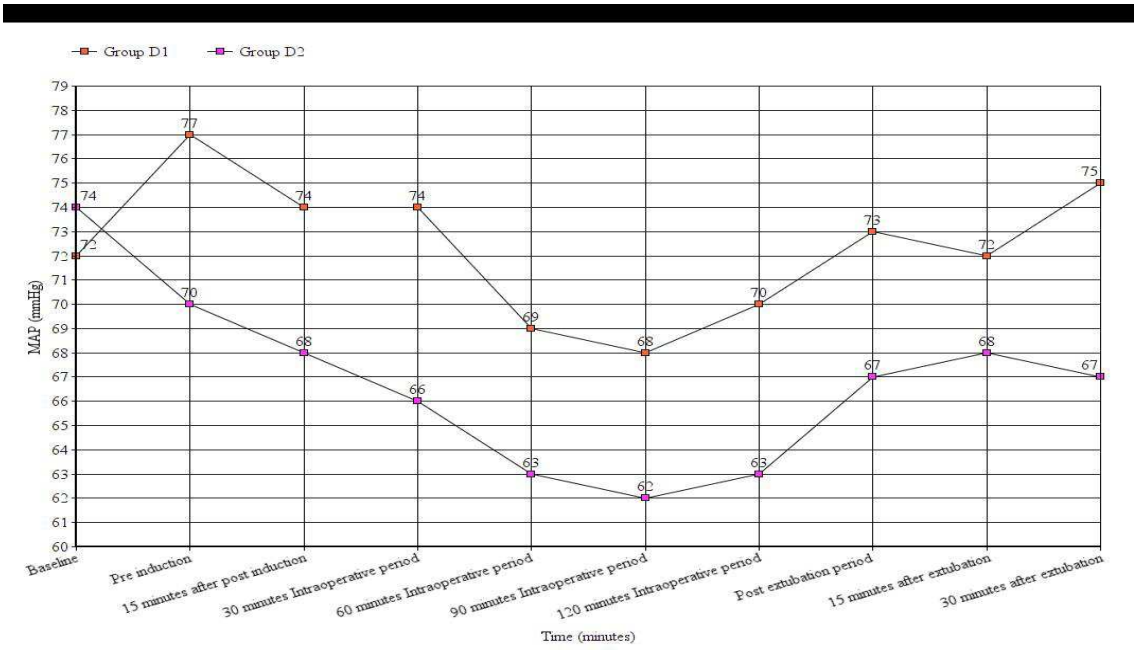
Group D1 0.5 mcg/kg intramuscular dexmedetomidine.
Group D2 1 mcg/kg intramuscular dexmedetomidine.

Data	Group D1	Group D2	P value
Age (Yr)	32±9.64	31.52±9.51	0.8601
Weight (Kg)	56±8.21	57.4±6.26	0.5008
Sex (Male/Female)	18/7	11/14	
ASA PS I/II	20/5	18/7	
Duration of surgery(in minutes)	92±21.8	85±22.15	0.2657

The basline hemodynamic parameters like mean arterial blood pressure and heart rate were comparable in both study groups. There was a significant reduction in MAP and heart rate in group D2 during the intra-operative period.

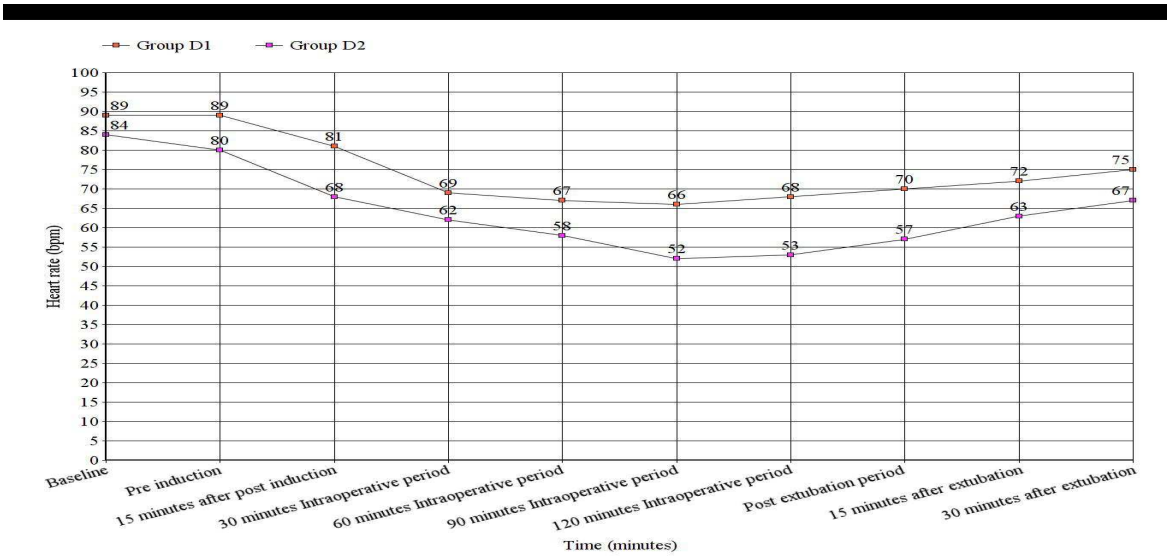
The MAP was maintained between 55-65mmHg in group D1 during the initial and maintenance phase of surgical anesthesia. There was no significant hemodynamic instability encountered in both groups. There was an additional requirement of nitroglycerine to provide hypotensive anesthesia in group D1 patients.

Figure 1 &2: Hemodynamic variation between study groups.



The mean intra-operative fentanyl consumption in group D2 was significantly less than D1 group. The MAC value of sevoflurane was significantly kept at lower value in group D2. The surgical field scoring by the operating surgeon based on Boerzaart scale was low in group D2 (Median score 2 vs 3) in the first 30 minutes of intra-operative period. There was satisfactory surgical field was observed by the operating surgeon in group D2 patients. (Median score 2 vs 1).

Emergence time and time needed to achieve ≥9 of modified Aldrete score were significantly prolonged in group D2 patients. The mean post-operative sedation score was significantly lower in group D2 than in group D1 at 30 min (2 vs 3)



and at 60 minutes there was no significant difference in score between two groups (3 vs 3). There was no significant awareness incidence noted in both study groups. The time to first rescue analgesia was significantly prolonged in group D2 patients. There was no significant side effects observed in both study groups (Nausea, vomiting, dizziness and pruritus).

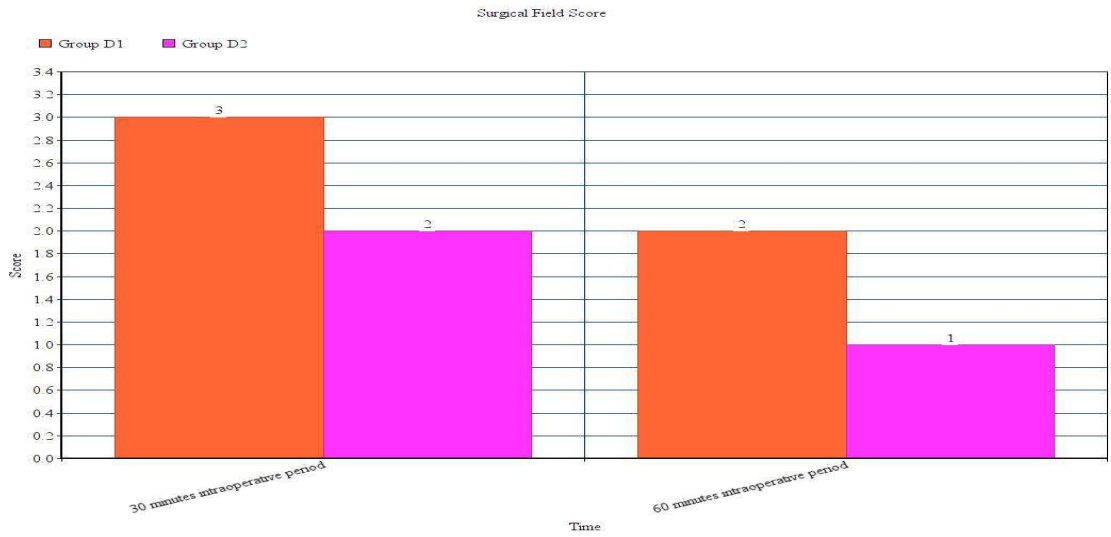


Table 2: Monitored other parameters in the study.

Parameters	Group D1	Group D2	P value
Emergence time (in minutes)	4.96±1.81	6.60±1.73	0.0020
Time to modified Aldrete score of ≥9	13.80±3.86	21.56±5.60	0.0001
Sedation score at 60 minutes (Mean)	2.4±0.58	3.08±0.57	0.0001
Time to first rescue analgesia (in minutes)	33.64±12.54	63.56±18.40	0.0001
Additional opioid usage (No. of patients)	6	0	

Discussion

Functional endoscopic sinus surgery needs hypotensive anaesthesia for clear surgical fieldto operate. A lot of effort has been done to optimize the surgical conditions for FESS. Various pharmacological agents like esmolol, remifentanil and vasodilators have been extensively used to provide controlled hypotensive anaesthesia [8,9,10,11,12]. A selective alpha-2 agonist like dexmedetomidine provides excellent surgical field in endoscopic sinus surgery when given via intravenous route. Butthe intramuscular dosage of dexmedetomidineand its role in providing hypotensive anaesthsia is not clearly defined. To evaluate or assess the optimal surgical field during endoscpic sinus surgery Boerzaart et.al defined a scoring system which is being used by the operating surgeon nowadays[10]. It is the modified scoring system of Fromme.

The results of our study showed that dexmedetomidine significantly lowered blood pressure and heart rate depending on the dosage. This was well correlated with study done by Scheinin [7] on pharmacokinetics and pharmacodynamics of intramuscular dexmedetomidine. In a study done by Aantaaet.al [4]1mcg/kg i.mdexmedetomidine reduced mean arterial pressure 20% of the baseline.Scheinin H et.al [13] evaluated the effects of intramuscular dexmedetomidine in the dosage of 2.5mcg/kg as premedication for the patients undergoing surgery under general anesthesia. But they reported the increased incidence of significant hypotension and bradycardia which required the usage of vasopressors in ASA physical status 1 or 2 patients. But this was not observed in our study population because we used lower dosage of intramuscular dexmedetomidine. The heart rate and mean arterial pressure were significantly lower during induction, surgery and post extubation period in the group D2 than group D1. It was quiet comparable with the result obtained by study done by Durmus et.al [15] for evaluating the effect of dexmedetomidine on bleeding during septorhinoplasty. It was observed that fentanyl and sevoflurane consumption was significantly increased in the group D1 than group D2.

We used Boerzaart scale for the operating field assessment (Score 0-5). It was the first proposed endoscopic surgical field grading scale published by Boerzaart et.al [10] in 1995 to objectively evaluate controlled hypotension with sodium nitroprusside in esmolol to facilitate sinus surgery. Based on our study report it was found that the surgical field score was lower in group D2 (Score $\leq$ 2) than group D1 (Score 2-3). It was an objective measurement and the ENT surgeon felt very easy to score the surgical field. Ayoglu H et.al [16] found that the dexmedetomidine reduces the bleeding and thereby lesser surgical field score in the study group. The sedative effects of dexmedetomidine after the surgery lasted for longer period in group D2 patients who received the dosage of 1mcg/kg intramuscularly. This was quiet comparable with the study done by Aantaa B et.al- intramuscular dexmedetomidine as premedication for minor gynaecological surgery.

Guven DG et. al observed that the time to first rescue analgesia was longer in the dexmedetomidine group than the control group in patients undergoing functional endoscopic sinus surgery. This was quiet comparable with our study. In our study post-operative side effects like nausea, vomiting, dizziness were not significantly observed in both groups. This result was not comparable with the study done by Guven et.al [17].

Conclusion

From our study we conclude that 1mcg/kg of dexmedetomidine dosage issufficient to provide sedation and analgesia. It provides clear surgical field for the operating surgeon. The surgical field assessment score will be quiet satisfactory with 1 mcg/kg of intramuscular dexmedetomidine than with 0.5mcg/kg. But still needsstudies involving larger sample size to effectively optimize the intramuscular dose of dexmedetomidine.

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Permission from IRB: Yes

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