

Dexmedetomidine versus Propofol for Monitored Anesthesia Care In Patients Undergoing Anterior Segment Ophthalmic Surgery Under Peribulbar Medial Canthus Anesthesia

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Abstract: Objective: Ophthalmic surgery is commonly performed under local anesthesia with propofol sedation. Dexmedetomidine, a sedative-analgesic, is devoid of respiratory depressant effects. This study compared the use of dexmedetomidine and propofol in patients undergoing anterior segment ophthalmic surgery (cataract and glaucoma). **Methods:** One hundred patients undergoing combined cataract and glaucoma surgery under peribulbar anesthesia were divided into two groups. The first group (Group D) received i.v. dexmedetomidine infusion 0.2-0.5 μ g/kg/min without loading. The second group (Group P) received propofol 25-75 μ g/kg/min i.v. infusion. Sedation was titrated using Richmond Agitation-Sedation Scale and bispectral index. Mean arterial pressure (MAP), heart rate (HR) oxygen saturation (SPO₂) and respiratory rate (RR) were recorded from the start of the infusion. Readiness for recovery room discharge (time to Aldrete score) and 7-point likert-like verbal rating scale were evaluated postoperatively. **Results:** Both groups provided a similar significant reduction in heart rate and mean arterial pressure compared with baseline. The oxygen saturation values of dexmedetomidine group were higher than those of propofol group. The respiratory rate values of the dexmedetomidine group were higher than those in the propofol group. Postoperatively, the time to achieve an Aldrete score of 10 was higher in propofol group. The patients' satisfaction was higher in the dexmedetomidine group. **Conclusion:** Compared with propofol, dexmedetomidine appears to be suitable for sedation in patients undergoing cataract surgery. While there was a slightly better subjective patient satisfaction, it was accompanied by relative cardiovascular depression and delayed recovery room discharge.

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1. Introduction

Combined surgery is most frequently performed under local anesthesia with monitored anesthesia care and sedation. Several drugs have been used for sedation during this procedure including benzodiazepines⁽¹⁾ and opioids. However, midazolam may result in confusion, particularly when administered to elderly patients, and opioids are associated with increased risk of respiratory depression and decreased oxygen saturation. All of these untoward effects may hamper patients' co-operation during surgery, and would make these agents less than ideal for the intraoperative management of sedation. In contrast, dexmedetomidine is a selective α_2 -adrenoceptor agonist with both sedative and analgesic properties and is devoid of respiratory depressant effect⁽²⁾. It has been used to premedicate and sedate patients undergoing day case surgery without adverse effects, and patients, typically, remain co-operative. These properties along with its relatively short elimination half-life of 2 hours make dexmedetomidine an attractive agent for sedation during monitored anesthesia care for ophthalmic surgery^(3, 4). Accordingly, this clinical study was undertaken to compare the effects of dexmedetomidine sedation with those of propofol sedation in patients undergoing

combined cataract and glaucoma surgery under medial canthus peribulbar anesthesia guided by ultrasound.

2. Methods

After Ethics Committee approval, 100 patients participated in this clinical study. Patients were included in the study if their ages ranged between 40 - 60 years, ASA class I, II or III and were undergoing elective surgery under local anesthesia. They were excluded if they had high serum creatinine, advanced liver disease, history of chronic use of sedatives, narcotics or allergy to any of the study medications. Patients were scheduled to receive either dexmedetomidine (Group D) or propofol (Group P) for sedation during surgery.

Patients arrived in the operating room, without previous premedication, a 20 gauge cannula was inserted into one of the two nasal prongs of an oxygen nasal cannula, and was connected proximally to the CO₂ sampling tubing of the end-tidal CO₂ module of the patient monitor (Ohmeda-Datex) to measure patients' expired CO₂. Oxygen was administered at a rate of 2 liters/min. Other standard monitors including ECG, non-invasive arterial pressure and pulse oximeter were also applied. Group D patients received a continuous infusion of dexmedetomidine 0.2- 0.5

$\mu\text{g/kg/min}$ ⁽⁵⁾, while group P patients received a continuous infusion of propofol 25-75 $\mu\text{g/kg/min}$ using an infusion pump. The infusion rate was titrated every 3 min according to Richmond Agitation-Sedation Scale (Table 1) ⁽⁶⁾ and a bispectral index between 80-70 % ⁽⁷⁾.

After starting infusion of the study drug, the anesthetist applied the electrodes of bispectral index to the head. Benoxinate 0.4%, as a surface anesthetic, was applied to the eye selected for operation. Peribulbar block was then performed, under ultrasound guide, by single injection in the medial canthus of 8ml local anesthetic mixture consisting of levobupivacaine 0.25%, Lidocaine 2% (in the ratio of 1:1) and hyaluronidase 10 units/ml. Heart rate (HR), mean

arterial pressure (MAP), respiratory rate (RR), oxygen saturation (SPO₂) and expired CO₂ were recorded every 5 min throughout the surgery. The infusion was stopped at the end of the surgery in both groups. In the recovery room, Aldrete score ⁽⁸⁾ was determined every 5 min until discharge and the requirement for postoperative analgesia was documented. Patients were deemed ready for discharge when they had achieved an Aldrete score of 10. Patients were asked to answer the question 'How would you rate your experience with the sedation you have received during surgery?' using 7-point likert like verbal rating scale ⁽⁹⁾ (Fig.1). Assessment of patients' satisfaction with sedation was performed 4 hours after the end of surgery.

Table (1) Richmond Agitation-Sedation Scale (RASS scale) ⁽⁶⁾

Score	Term	Description	
+4	Combative	Overtly combative, violent, immediate danger to staff	
+3	Very agitated	Pulls or removes tube(s) or catheter(s); aggressive	
+2	Agitated	Frequent non-purposeful movement, fights ventilator	
+1	Restless	Anxious but movements not aggressive vigorous	
0	Alert and calm		
-1	Drowsy	Not fully alert, but has sustained awakening (eye-opening/eye contact) to <i>voice (>10 seconds)</i>	} Verbal Stimulation
-2	Light sedation	Briefly awakens with eye contact to <i>voice (<10 seconds)</i>	
-3	Moderate sedation	Movement or eye opening to <i>voice (but no eye contact)</i>	
-4	Deep sedation	No response to voice, but movement or eye opening to <i>physical stimulation</i>	} Physical Stimulation
-5	Unarousable	No response to <i>voice or physical stimulation</i>	

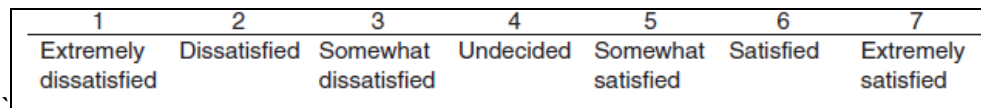


Fig. (1) A 7-point Likert-like verbal rating scale for assessment of patients' satisfaction with intraoperative sedation ⁽⁹⁾

Statistics

The number of patients in this study was determined on the basis of the results of preliminary investigations during which the sample size was calculated to be 50 patients per group based on the reduction in heart rate in both groups during the sedation period as the primary endpoint, a population variance of (2) ², a two sided α of 0.05, and a power of 90%. Sample size calculation program version 2.1.31 was used. The statistical analysis of our results was conducted using the computer program SPSS for windows.

3. Results

A total of 100 patients were recruited in this study. The two groups were comparable with respect to the following variables: age, sex, weight, height and ASA status (Table 2). Total anesthesia time was 50.39 \pm 12.28 min in group D and 49.9 \pm 9.566 min in group P, and operation time was 35.03 \pm 7.62 min and

37.73 \pm 6.26 min in group D and P, respectively. These were comparable between the two groups. The time required from the start of the infusion of the study drugs to achieve targeted levels of sedation was significantly longer in the dexmedetomidine group (15.36 \pm 4.66) than in the propofol group(11.96 \pm 3.27) ($P=0.0015$). Group P patients achieved an Aldrete score of 10 faster than group D, thus, ready for discharge sooner. However, there was no significant difference in the Richmond Agitation-Sedation Scale (Fig.1).

On the other hand, the 7-point Likert-like verbal rating scale for assessment of patients' satisfaction with intraoperative sedation in Group D was 6.53 \pm 0.63 compared with 5.39 \pm 0.98 in Group P (Table 2).

Changes of hemodynamic and respiratory variables are presented in figures in both groups. There was a similar significant reduction in HR and MAP compared with baseline in both groups (Figs. 3, 4) respectively.

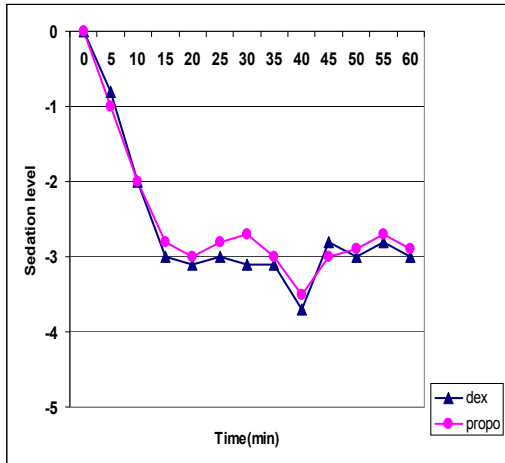


Fig.(2): Richmond Agitation-Sedation Scale during intraoperative period

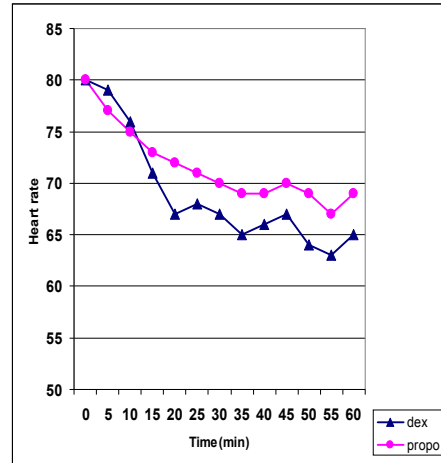


Fig.(3): Heart rate (HR) changes during intraoperative period

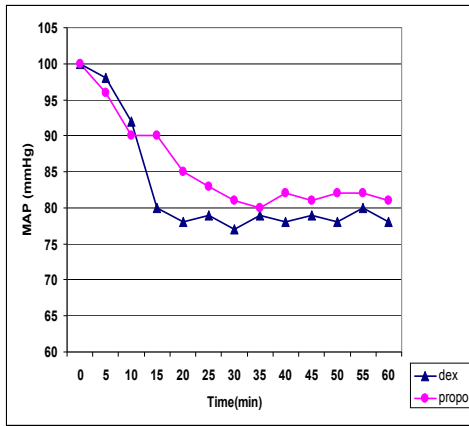


Fig.(4): Mean arterial blood pressure (MAP) changes during intraoperative period

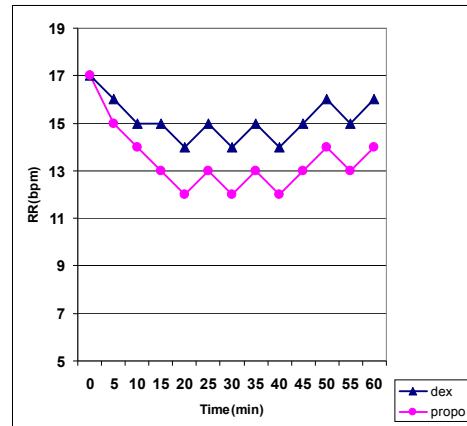


Fig.(5): Respiratory rate (RR) changes during intraoperative period

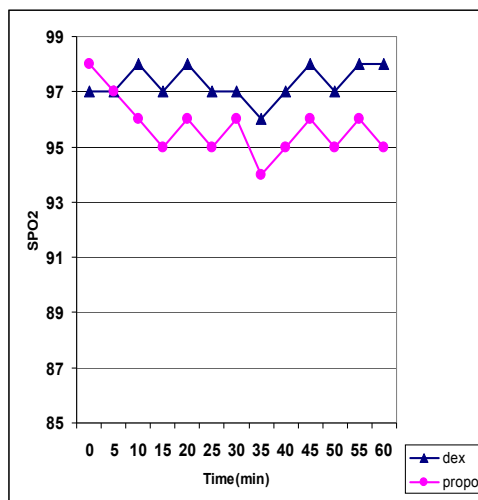


Fig. (6) Oxygen saturation (SPO₂) changes during intraoperative period

Table (2) Demographic Data

	Group D (n=50)	Group P (n=50)	P value
Age (yr)	50.26±9.44	51.9±10.02	NS
Weight (kg)	69.00±5.634	70.46±6.64	NS
Sex (M/F)	30/20	26/24	NS
Height(cm)	162.7±4.5	163.7±3.6	NS
ASA class I/II/III (n)	14/32/4	13/30/7	NS

Table (3) clinical data of the study groups

	Group D	Group P	P-value
Duration of surgery (min)	35.03±7.62	37.73±6.29	NS
Time to achieve adequate sedation level	15.36±4.66	11.96±3.27*	0.0015
Time to achieve an Aldrete score of 10 (min)	40.53 ±6.51	37.60±6.42	NS
Degree of patient's satisfaction (a 7-point likert-like verbal rating scale)	6.53±0.63	5.39 ±0.98*	0.026

Data presented as mean ± standard deviation
NS Statistically insignificant

* Statistically significant compared to group D

RR values in the dexmedetomidine group were significantly higher than those in the propofol group during the sedation period ($P<0.05$) (Fig.5). The SPO₂ values in the dexmedetomidine group showed less change from baseline values, while there was significant reduction in the SPO₂ in the propofol group ($P<0.05$) compared with the baseline values (Fig.5). SPO₂ values in the dexmedetomidine group were significantly higher than those in the propofol group during the sedation period ($P<0.05$) (Fig.6). The expired CO₂ values were similar in both groups. In the immediate postoperative period, all the cardiorespiratory measures returned back to the normal preoperative values within 17 minutes.

4. Discussion

In this study, our results suggest that dexmedetomidine is a good and safe drug for monitored anesthesia care (MAC) in outpatients undergoing combined cataract and glaucoma surgery. Dexmedetomidine has been used in short or long term sedation in the intensive care unit, being unique in that it does not cause respiratory depression because its mechanism of action is not mediated by the γ -aminobutyric acid system. This has been proved in critically ill patients given dexmedetomidine during surgery as well as those given the drug for short term. In addition to this singular property of dexmedetomidine, no use of rescue sedative or analgesic drugs might also contribute to less respiratory depression.

This study demonstrated that sedation with dexmedetomidine was equally effective to that of propofol in patients undergoing combined cataract surgery under local anesthesia. This was evident from the facts that none of the patients in either group required rescue sedation, and that surgeons were equally satisfied with both sedative regimens⁽¹⁰⁾.

These results are correlating with those reported by **Virkkila and colleagues**⁽¹¹⁾, who have demonstrated that a single dose of i.m. dexmedetomidine administered 45 min before operation provides sedation. Use of loading dose of dexmedetomidine is still controversial because of the development of cardiovascular depression. Dexmedetomidine at a rate of 0.25-2 $\mu\text{g}/\text{kg}$ resulted in a reduction of arterial pressure and cardiac output. Although large doses (1 or 2 $\mu\text{g}/\text{kg}$) of dexmedetomidine produced the initial increase of arterial pressure temporarily, presumably due to peripheral vasoconstriction⁽³⁾, in this current study, loading dose of dexmedetomidine was omitted. There were results reporting that appropriate sedation and stable hemodynamics were achieved in the absence of loading dose of dexmedetomidine⁽¹²⁾ and the incidence of hypotension was decreased in ICU sedation without the loading dose⁽¹³⁾. For various procedures however, its efficacy outside the critical care environment has also been documented.

This study demonstrated that both drugs were effective in providing adequate intraoperative sedation, the dexmedetomidine group (Group D) patients were more satisfied with their sedation than those of the propofol group (Group P). This could be explained, at least in a way, by the additional analgesic property of dexmedetomidine that could have contributed to improved patients' perception of this form of sedation, and in another way, by potential differences in the quality of sedation of the two drugs⁽¹⁴⁾. The lower mean arterial pressure (MAP) and heart rate (HR) observed in the dexmedetomidine group (Group D) could be explained by the decreased sympathetic outflow and circulating levels of catecholamines that are caused by dexmedetomidine. Similar hemodynamic changes have been reported by Arain and Ebert, who compared the sedative effect of dexmedetomidine and propofol during surgery under regional anesthesia⁽¹⁵⁾.

Moreover, intraoperative respiratory rate (RR) and oxygen saturation (SPO₂) of the dexmedetomidine group (group D) were somewhat superior to those of the propofol group (group P).

In summary; compared with propofol, dexmedetomidine does appear to be suitable for sedation in patients undergoing combined cataract and glaucoma surgery. While there was a slightly better subjective patient satisfaction, it was accompanied by relative cardiovascular depression and delayed recovery room discharge. In addition, most of the patients were outpatients and elderly, thus dexmedetomidine might have more advantages over other commonly used sedatives.

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