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Original Research Paper

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INFUSION PROPOFOL VERSUS DEXMEDETOMIDINE FOR MONITORED ANAESTHESIA CARE- A COMPARATIVE STUDY

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ABSTRACT

Background: Monitored anaesthesia care combines administering a variety of medications used to diminish anxiety and apprehension of patients with a depressed level of consciousness without overwhelming the protective reflexes.(1) We aimed to compare the sedative efficacy and safety of propofol infusion with dexmedetomidine infusion. **Method:** In this prospective single-blinded comparative study, patients included were randomly divided into two groups of 60 patients each to receive either dexmedetomidine [group-D] or propofol infusion [group-P]. The primary goals were to achieve a sedation score of 2–3 on the Ramsay sedation scale (RSS) and to compare the hemodynamic stability; respiratory depression or any complications due to technique or medications were also recorded as secondary outcomes. **Results:** Intraoperative heart rate and mean arterial pressure in group-D were lower than the baseline values and the corresponding values in group-P ($P < 0.001$). The decrease in respiratory rate was smaller with propofol when compared with dexmedetomidine, but, in the propofol group, fall in oxygen saturation was greater than that with dexmedetomidine. All the patients in both groups reached desired level of sedation (score of 2–3 on the RSS). Group-D patients achieved lower visual analogue and numerical pain scores when compared to group P ($P < 0.001$) in the post-operative period. The requirement for rescue analgesia intra-op and post-op was less the in dexmedetomidine group when compared to propofol. **Conclusion:** The relative clinical efficacy in terms of hemodynamic stability and analgesia of dexmedetomidine was significantly better compared with propofol, but level of sedation was the almost same.

KEYWORDS : Monitored Anaesthesia Care, Dexmedetomidine, Propofol, Ramsay sedation scale.

INTRODUCTION

Midazolam, fentanyl, and propofol currently used for monitored anaesthesia care (MAC) are associated with limitations like respiratory depression, disorientation, hypotension, and gastrointestinal hypomotility. Hence, dexmedetomidine a novel agent which provides adequate sedation and analgesia with minimal respiratory depression is compared with gold standard propofol.

Dexmedetomidine acts primarily on the sleep pathway and does not inhibit the activity of the orexinergic neurons, which is the basis of its arousable sedation. Moreover it has sympatholytic action which not only decreases the stress response to surgery but also the surges in heart rate and blood pressure.

METHODS

After institutional ethics committee approval, this study was conducted on American Society of Anaesthesiologists (ASA) physical status I or II adult patients of either sex, aged 18 to 60 years posted for elective surgical procedures lasting less than 3hrs under regional/local anaesthesia like upper limb orthopaedic or plastic surgery procedures, middle ear surgeries, nasal septal procedures etc.

All patients underwent pre-anaesthetic check-up for detailed history, examination and appropriate investigations and adequate fasting was ensured. Group allocation was done according to computer generated random number table. Standard monitoring was instituted for all patients throughout the surgical procedure. Patients were premedicated with injection ondansetron 0.08mg/kg , injection glycopyrrolate 0.004mg/kg and injection fentanyl 1.5mcg/kg intravenously before injecting study drug. Oxygen was provided to all patients via face mask throughout the surgery.

According to group allocation patients of group-D received bolus of dexmedetomidine 1μg/kg over 10min, followed by a maintenance infusion of 0.5μg/kg/min throughout the surgery and patients of group-P received bolus of propofol 0.75mg/kg followed by 0.025mg/kg/min infusion throughout the surgery. And the rate was adjusted to achieve the desired score of sedation 2–3 on Ramsay sedation scale(RSS).

The syringes containing above drugs in two study groups was prepared as follows :
Group-D - Injection dexmedetomidine 4mcg/ml (200mcg of drug in 50ml of normal saline) in 50ml syringe
Group-P - Injection propofol (Fresofol) 20ml (1%) and injection xylocard 2ml (2%) was added to freshly prepared propofol in 50ml syringe.

The syringes were installed in syringe pump (B Braun) and a minimum period of 5min between adjustments was allowed for onset of peak drug effect. Haemodynamic parameters and RSS score were recorded at premedication, during regional/local anaesthesia, at beginning of study drug infusion and at 15min interval till the end of surgery. In the recovery room and post op period along with this visual analogue scale (VAS) and numerical pain scale (NPS) scores were also noted which was explained to the patient pre-operatively. Intra-op top-up doses were given in the form of injection fentanyl 0.5mcg/kg in cases where patients complained of pain, discomfort or tachycardia or hypertension noted signifying pain. Injection paracetamol 1gm was given intravenously to all patients undergoing middle ear and septal surgeries. In case of orthopaedic and plastic surgery cases where regional block was given, paracetamol injection was used as and when needed.

Descriptive analysis was carried out by mean and standard deviation for quantitative variables, frequency and proportion for categorical variables. Data was also represented using appropriate diagrams like line graph. The association between categorical explanatory variables and quantitative variable was assessed by comparing the mean values. The mean differences along with their 95% CI were presented. Independent sample t-test was used to assess statistical significance. Mann Whitney U test was used to assess

statistical significance. Chi square test was used to test statistical significance.

P value < 0.05 was considered statistically significant.
IBM SPSS version 21 was used for statistical analysis.

RESULTS

Table 1, Showing The Comparison Of Demographic Details Of Both The Groups

Study variables	Group-D N=60	Group-P N=60	p value
Sex- male: female	36:24	35:25	0.853
ASA grade - I/II	46/14	49/11	0.5

A total of 120 patients were randomly allocated into two groups of 60 each. Both groups were comparable with respect to demographic variables and are shown in table 1.

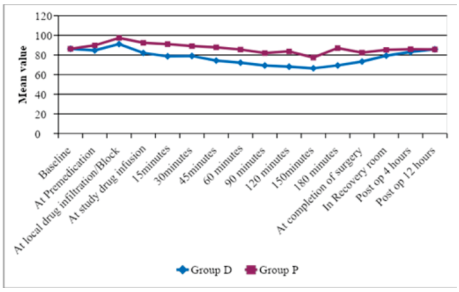

Figure 1, Showing Comparison Of Mean Heart Rate Variation Between Two Study Groups Throughout The Surgery And Upto Post Op 12 Hours.

Heart rate (HR) variations assessed at different timelines in the study showed in Figure 1; comparable baseline values (p=0.987), at premedication the mean heart rate slightly reduced in Group-D (84.65 ± 11.36) and slightly increased in Group-P (89.83 ± 11.61), during local anaesthetic infiltration or peripheral nerve block the mean heart rate increased both the groups (D =91.15 ± 12.96 and P=97.35 ± 12.17) and from study drug infusion till the end of surgery mean heart rate showed significant fall from baseline among Group-D and this trend was observed throughout the surgery. Group-P also showed fall in mean heart rate but the fall in mean heart rate in Group-P was lower than the fall in mean heart rate in Group-D, which is consistent with pharmacological action of dexmedetomidine and was statistically highly significant with p value of <0.001. In recovery room, the mean heart rate significantly reduced in Group-D (79.28 ± 7.81) when compared to baseline, whereas it was only slightly reduced in Group-P (85.20 ± 8.66). During post op 4th and 12th hour, the mean heart rates were almost close to baseline in both the groups (Group-D =83.08 ± 7.93 and 85.78 ± 6.74 respectively and Group-P =85.83 ± 7.73 and 85.62 ± 6.04 respectively). 10% of study patients had bradycardia (HR less than 60) in Group-D and no bradycardia was noticed in Group-P.

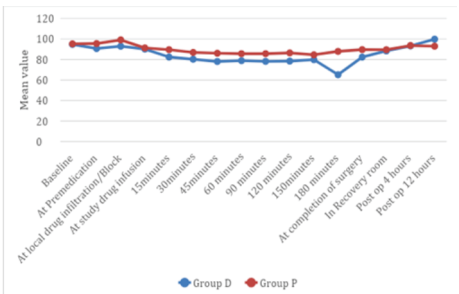

Figure 2, Showing Comparison Of Mean MAP Variation Between Two Study Groups Throughout The Surgery And Upto Post Op 12 Hours.

Variation in mean MAP (mean arterial pressure) in both groups throughout the surgery is shown in Figure 2. The mean baseline MAP was almost similar in both the groups (D=94.70 ± 10.57 and P=95.23 ± 7.39). During premedication and local drug infiltration/regional block, the mean MAP reduced in Group-D (90.65 ± 10.78 and 92.91 ± 10.94 respectively) whereas it slightly increased in group P (=95.51 ± 7.40 and 99.11 ± 8.14 respectively) which was found to be statistically significant with P value of 0.005 and 0.001 respectively.

From the beginning of study drug infusion mean MAP showed significant fall from baseline throughout the surgery among Group-D, Group-P also showed fall in mean MAP but the fall in mean MAP in Group-P was lower than the fall in mean MAP in Group-D with P value <0.001 which was statistically highly significant. In the recovery room and post op period MAP reached to almost baseline values in both groups.

The respiratory rate varied between 16 to 18 in Group-D and 18 to 20 in Group-P. Baseline respiratory rate was numerically higher but physiologically within normal limits in Group-P compared to that in Group-D and this variation remained constant throughout surgery and was found to be statistically insignificant. The saturation varied between 98 to 100% throughout the surgery in both the groups, however it was noticed that one patient of Group-D and five patients of Group-P had hypoventilation (saturation <95%) which was managed by 100% oxygen and/or jaw thrust. All the patients in both the groups reached desired level of sedation (score of 2–3 on the RSS) at the end of 15minutes after study drug infusion and same level of sedation was maintained in both the groups throughout the surgery. Immediately upon arrival into the recovery room, all the patients were able to obey commands.

Table 2 Showing Percentage Of Patients Having Various Vas Scores In Recovery Room (RR) And Post Op Period. Lowest VAS=2 Was Found In Group-d In RR Whereas Group-p Showed Lowest VAS Score=3 In The RR.

VAS (0 to 10)	Group D	Group P
In Recovery room	2 - 8 (13.3%)	3 - 28 (46.6%)
	3 - 38 (63.3%)	4 - 22 (36.6%)
	4 - 11 (18.3%)	5 - 10 (16.6%)
	5 - 3 (5%)	6 - 0%
At post-op 4th hour	3 - 36 (60%)	3 - 15 (25%)
	4 - 21 (35%)	4 - 25 (41.6%)
	5 - 3 (5%)	5 - 20 (33.3%)
	6 - 0%	6 - 0%
At post-op 12th hour	3 - 32 (53.3%)	3 - 18 (30%)
	4 - 24 (40%)	4 - 24 (40%)
	5 - 4 (6.6%)	5 - 12 (20%)
	6 - 0%	6 - 6 (10%)

Table 3 Showing Percentage Of Patients Having Various Nps Scores In Recovery Room (RR) And Post Op Period. Lowest NPS=2 Was Found In Group-d In RR Whereas Group-p Showed Lowest NPS Score=3 In The RR.

NPS (0 to 10)	Group D	Group P
In Recovery room	2 - 8 (13.3%)	3 - 31 (51.6%)
	3 - 41 (68.3%)	4 - 23(38.3%)
	4 - 9 (15%)	5 - 6(10%)
	5 - 2 (3.3%)	6 - 0%
At post-op 4 hours	3 - 47 (78.3%)	3 - 17 (28.3%)
	4 - 20 (33.3%)	4 - 27 (45%)
	5 - 3 (5%)	5 - 9 (15%)
	6 - 0%	6 - 7 (11.6%)
At post-op 12 hour	3 - 34 (56.6%)	3 - 17 (28.3%)
	4 - 20 (33.3%)	4 - 25 (41.6%)
	5 - 6 (10%)	5 - 12 (20%)
	6 - 0%	6 - 6 (10%)

Description of VAS and NPS score are shown in table 2 and 3 respectively. Both the scores were assessed in recovery room,

in post-op period 4th and 12th hours.

Table 4: Comparison Of Intra-op Injection Fentanyl Top ups and/or NSAIDs Between Two Group

Intra-op analgesic top-up doses	Group D	Group P
No. of inj.fentanyl doses	34	39
No. of inj.PCM doses	44	47
Total no. of top up doses	78	86

Comparison of requirement of intra-op injection fentanyl top-ups and/or NSAIDs in both groups are shown in table 4. Total number of intraoperative top-ups required of injection fentanyl and injection paracetamol were 34 and 44 in Group-D and 39 and 47 in Group-P respectively. This shows that patients in Group-D experienced less pain and hence required less analgesia compared to Group-P.

Table 5: Comparison Of Requirement Post-op NSAIDs Top ups Between Two Group

Post-op top up doses of NSAIDs up-to 12 hours	Group D	Group P
Number of injection Paracetamol doses	Up-to 4hrs- 3(5%) Up-to 12hrs- 60(100%)	Up-to 4hrs- 6(10%) Up-to 12hrs- 60(100%)
Number of injection Diclofenac doses	Up-to 4hrs- 0(0%) Up-to 12hrs- 30(50%)	Up-to 4hrs- 0(0%) Up-to12hrs- 37(61.6%)
Number of injectionTramadol doses	Up-to 4hrs- 5(8.3%) Up-to 12hrs- 6(10%)	Up-to 4hrs- 9(15%) Up-to 12hrs- 18(30%)
Total noumber of top up doses	Up-to 4hrs- 8 Up-to 12hrs- 96	Up-to 4hrs- 15 Up-to 12hrs- 115

Table 5 shows comparison of requirement of post op NSAIDs in both groups. Total number of top up doses administered in Group-D and Group-P at post-op 4th hour were 8 and 15 respectively; and at post-op 12th hour were 96 and 115 respectively. This clearly shows that requirement of post-op analgesia is also less in dexmedetomidine group compared to propofol group.

DISCUSSION

Surgical anaesthesia is a pharmacologically induced state that renders the patient insensible to noxious surgical stimulation. It is not a single pharmacologic process but is the result of the interaction of hypnotics and analgesics in a synergistic manner. The hypnotic component (unconsciousness) is created by the administration of intravenous and inhaled anaesthetics, whereas the analgesic component is created by the administration of either intravenous opioids or regional anaesthetics. Continuous infusion of a short-acting drug is superior to intermittent bolus dosing, as it produces less fluctuation in drug concentration and also reduces the total drug requirement. In this study drug infusion was titrated using infusion pump to avoid excessive sedation. Whenever there was increase or decrease in noxious stimulus, the drug infusion rate was increased or decreased accordingly.

Propofol has sedative–hypnotic properties for use in monitored anaesthesia care but has only minimal analgesic property. The context-sensitive half-time of propofol remains shortened even after prolonged infusion. It may cause some respiratory depression and hemodynamic instability but showed excellent recovery profile.(2)

Dexmedetomidine is a highly selective α-2 adrenergic receptor agonist and produces both analgesia and cooperative sedation, a state closely resembling physiological stage II of nonrapid eye movement sleep, and hence the patients can be easily awakened. This action is not mediated by γ-aminobutyric acid-mimetic system, and hence it does not depress the respiratory drive during sedation and had little effect on ventilation. The activation of the α-2 agonist receptors in the brain (locus coeruleus) and the spinal cord decreases sympathetic outflow causing dose-dependent sedation, analgesia, hypotension, and bradycardia.(3)

In the current study we decided to compare Dexmedetomidine and Propofol for level of sedation, requirement of analgesia and hemodynamic stability in patients posted for elective surgeries under regional anaesthesia.

Both groups were comparable with respect to demographic variables (age, gender) (Table 1) and baseline vital parameters (HR, systolic BP, diastolic BP, mean arterial BP). (Figure 1 &2)

Kumkum Gupta et al(4) conducted a comparative study in 2015 on Monitored anaesthesia care with propofol and dexmedetomidine for patients undergoing upper limb surgeries under brachial plexus blockade. This study showed that intraoperative dexmedetomidine infusion effectively stabilized the hemodynamic parameters of HR and BP when compared with intraoperative propofol infusion. Hypotension was observed in 11 patients of the propofol group and bradycardia in 5 patients of the dexmedetomidine group.

Our study also showed that intraoperative dexmedetomidine infusion effectively stabilized the hemodynamic parameters of HR and BP when compared with intraoperative propofol infusion. Hypotension was observed in 4 patients of dexmedetomidine group and 3 patients of the propofol group which was managed with rapid intravenous infusion of crystalloid solution and vasopressor administration. Bradycardia was observed in six patients of the dexmedetomidine group because of its effect on α-2 adrenoceptors, which was managed by reducing the rate of dexmedetomidine infusion and administering injection glycopyrrolate.

Dexmedetomidine has a property of decreased sympathetic outflow, decreases catecholamine levels and also additional vagal mimetic effect. This explains lower HR and MAP (Figure 1&2) in Group-D compared with that in Group-P. The analgesic property of dexmedetomidine reduces sympathetic stimulation which also reduces MAP. These results confirm that dexmedetomidine has an advantage over propofol in providing a better surgical field. Srivastava et al(5) have also noticed this property of dexmedetomidine for maintaining haemodynamic stability in patients for microscopic spine surgeries and observed that dexmedetomidine is a useful adjuvant to decrease bleeding when a bloodless operative field is required.

Thomas J Ebert et(6) al studied the Effects of Increasing Plasma Concentrations of Dexmedetomidine in Humans. They observed that only minimal effects of dexmedetomidine on the respiratory system throughout a broad range of plasma concentrations. Minute volume was not measured, but PaO2 was well-maintained throughout. However, more pronounced respiratory effects have been reported when dexmedetomidine is rapidly infused to high concentrations.

In our study, decreases in respiratory rate were smaller with propofol when compared with dexmedetomidine but, in the propofol group, the fall in oxygen saturation was more than that with dexmedetomidine. This may be related to the effect on tidal volume, i.e., in the dexmedetomidine group, although respiratory rate decreased, tidal volume probably remained unchanged or increased, whereas in the propofol group tidal volume probably decreased, while respiratory rate did not

change. Because we added fentanyl to the management of all patients, its effect should also be considered to impact respiratory function. In addition, the effects of sedatives on respiratory depression may be widely influenced by the balance between pain and the effects of the administered sedatives/opioid. Sedative doses of propofol have minimal depressant effects on tidal volume and minute ventilation, with end-tidal CO_2 tension and arterial blood gas values remaining unchanged. However, larger doses of propofol can depress the hypoxic ventilatory response and cause more frequent and longer apnoea than barbiturates.(7)

All the patients in both the groups reached desired level of sedation (score of 2–3 on RSS) at the end of 15minutes after study drug infusion and same level of sedation (mean score of 3 on the RSS) was maintained in both the groups throughout the surgery. Immediately upon arrival into the recovery room, all the patients were able to obey commands. In recovery room, at post op 4^{th} and 12^{th} hour patients in both the groups had maintained RSS of 2. Hence in terms of sedation both dexmedetomidine and propofol had similar effects.

In our study, we observed that in the dexmedetomidine group patients achieved lower VAS (Table-2) and NPS(Table-3) scores when compared to propofol group which was assessed during post-operative period. We found that requirement of rescue analgesia intra-op(Table-4) and post-op(Table-5) was less in dexmedetomidine group when compared to propofol group hence dexmedetomidine has better analgesic properties than propofol which is similar to study conducted by Kaygusuz et al.(8)

CONCLUSION

The intraoperative dexmedetomidine infusion produces adequate sedation, maintain the hemodynamic stability with respiratory adequacy, and enhanced the duration of postoperative analgesia. The relative clinical efficacy in terms of hemodynamic stability and analgesia of dexmedetomidine was significantly better compared with propofol but level of sedation was almost same.

REFERENCES

1. American Society of Anesthesiologists. Distinguishing monitored anesthesia care (MAC) from moderate sedation/analgesia (conscious sedation); 2009. Available at: http://www.asahq.org. [Last accessedSeptember 2018].
2. Smith I, Monk TG, White PF, Ding Y. Propofol infusion during regional anesthesia: sedative, amnestic, and anxiolytic properties. Anesthesia and analgesia. 1994 Aug 1;79(2):313-9.
3. Ramsay MA, Luteman DL. Dexmedetomidine as a total intravenous anaesthetic agent. Anaesthesiology 2004;101: 787-790.
4. Gupta K, Tyagi V, Gupta PK, Rastogi B, Jain M, Bansal M. Monitored anesthesia care with propofol or dexmedetomidine for patients undergoing upper limb surgeries under brachial plexus blockade: a comparative study. Ain-Shams Journal of Anaesthesiology. 2016 Oct 1;9(4):563.
5. Srivastava VK, Agrawal S, Kumar S, Khan S, Sharma S, Kumar R. Comparative evaluation of dexmedetomidine and propofol along with scalp block on haemodynamic and postoperative recovery for chronic subdural haematoma evacuation under monitored anaesthesia care. Turkish journal of anaesthesiology and reanimation. 2018 Feb;46(1):51.
6. Candela Toha AM, Benatar Hasserfaty J, Ascorve Dominguez A. Induction and maintenance of anesthesia with propofol and with thiopental-isoflurane: comparative study. Rev Esp Anestesiol Reanim 1991;38:218–21
7. Rosa G, Conti G, Orsi P, D'Alessandro F, La Rosa I, Di Giuqno G, Gasparetto A. Effects of low-dose propofol administration on central respiratory drive, gas exchanges and respiratory pattern. Acta Anaesthesiol Scand 1992;36:128–31
8. Kaygusuz K, Gokce G, Gursoy S, Ayan S, Mimaroglu C, Gultekin Y. A comparison of sedation with dexmedetomidine or propofol during shockwave lithotripsy: a randomized controlled trial. Anesthesia & Analgesia. 2008 Jan 1;106(1):114-9.