Comparative Effects Of Propofol Infusion Versus Sevoflurane For Maintenance Of Anesthesia For Spine Surgery

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Citation

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Abstract

Thirty patients of ASA grade I and II posted for elective spine surgery in prone position under general anesthesia were selected for the study. The patients were randomly assigned into two groups, Sevoflurane (Group S, n=15) and Propofol (Group P, n=15).A standard premedication and induction regimen was followed in all cases. Group S patients received N_2O / O_2 / Sevoflurane / Vecuronium and Group P received N_2O / O_2 / Propofol infusion / Vecuronium for maintenance of anesthesia to a desired level. Recovery was assessed with a simulated wake up test and a simple behavioral score was employed to assesses the over all recovery. The observation revealed that maintenance of anesthesia with sevoflurane was associated with a faster recovery than propofol anesthesia. But in a pharmacoeconomic based approach the increased cost of sevoflurane has to be linked with the benefits of rapid emergence.

INTRODUCTION

In a hospital that is hard pressed to operate more number of cases per day, the technique of administering anesthesia should be modified in such a way that the patient can be extubated early and the operating room time for each patient can be minimized. In order to do so shorter acting intravenous anesthetics that can be administered in infusion form or inhalational agent with low blood solubility with faster induction and recovery have been tried by many anesthesiologist for maintenance of anesthesia([1,2]).

The brevity of action and rapid recovery with propofol has led to extensive usage of this agent for maintenance of anesthesia along with oxygen and nitrous oxide([3,4]).Similarly the newly introduced volatile anesthetics to Indian scenario , Sevoflurane also allow faster recovery from anesthesia ([2]) because of its favorable pharmacokinetic properties.

Although the clinical effects , recovery profile and the cost of administering propofol and sevoflurane have been measured separately in various outpatient operations but have not been evaluated in patients undergoing long surgical procedures like laminectomy([5]). So the present study has been carried out to compare Sevoflurane with that of propofol infusion for maintaining anesthesia with respect t hemodynamic characteristics and recovery profile.

PATIENTS AND METHODS

After ethical committee approval and patients informed consent the study was initiated in thirty adult patients of ASA physical status grade I and II scheduled for elective spinal surgery in prone position under general endotracheal anesthesia with controlled ventilation. The patients were randomly assigned into two groups of fifteen each depending on whether they received sevoflurane (Group S) or propofol infusion (Group P) for maintenance of anesthesia.

A standard premedication regimen 9 tablet Diazepam5 mg oral; Inj Glycopyrolate 0.2mg intramuscular) was given to all patients one hour before surgery. In both groups patients were induced with Thiopentone 4-7 mg per Kg., midazolam 2.0 mg and Fentanyl 2mcg per kg.Vecuronium 0.1mg per Kg was given for muscle relaxation and was followed by tracheal intubation and intermittent positive pressure ventilation in a closed system using a circle absorber with a fresh gas flow of 2 litres per minute.

In Group S , anesthesia was maintained with sevoflurane along with a mixture of O_2:N_2O :: 50:50 and supplemental vecuronium.In Group P , anesthesia was maintained by 1% propofol, 1mg per Kg bolos followed by continuous propofol infusion with a syringe pump along with O_2:N_2O :: 50:50 and vecuronium.

The concentration of sevoflurane used and the rate of infusion of propofol were at the discretion of the anesthesiologist so as to maintain adequate depth of anesthesia (defined as a variation in heart rate and mean arterial pressure with in 10% of the base line value. Fentanyl 1mcg per kg was supplemented hourly. After completion of surgery the patient had been turned to supine position and once the patient show spontaneous breathing attempt anesthetic agent were stopped. Residual neuromuscular blockade was antagonized with neostigmine and glycopyrolate. Intraoperative hemodynamic parameters were noted at regular interval. Recovery was assessed with a simulated wake up test (6). The patients were asked to open their eyes, squeeze the hands and the time interval from cessation of anesthetic was recorded. A simple behavioral score (1= calm / cooperative / good, 2= drowsy but arousable, 3= confused / restless / disoriented, 4= drowsy / unable to obey command) was employed to assess the overall recovery (6). All the data thus generated were analysed statistically using standard error of difference between the mean (SEM) to define the level of significance.

RESULTS

A randomized prospective study was carried out in 30 patients divided into two groups of fifteen each. Both the groups were comparable demographically in respect to age, body weight and sex ratio. (Table I).

Figure 1

Table 1: Demographic profile (mean ± SD)

Parameter	Group S 9n=15)	Group P(n=15)
Age (Year)	43.9 ± 4.3	40.1 ± 6.4
Body weight (Kg)	50.8 ± 4.8	50.1 ± 3.6
Sex (M:F)	11:4	10:5
Duration of anesthesia (minutes)	213.5 ±39.1	206.7 ± 18.6

The mean arterial pressure (MAP) showed a significant increase after intubation in both the groups. After this initial rise in MAP, in Group P, there was significant fall in MAP and this was maintained at a lower level compared to base line value through out the surgery. But in Group S the MAP was better controlled after the initial rise in post intubation period (Table II, Graph I)There was significant rise in the heart rate (HR) in both the groups after intubation and this remained above the base line value throughout the surgery.(Table II, Graph –II). Although there were significant changes in intraoperative hemodynamic parameters, all the values were with in the acceptable limit. There were no significant variation in individual requirement of Thiopentone, fentanyl and intravenous fluid. (Table III).

Figure 2

Graph 1: Change In Mean Arterial Pressure

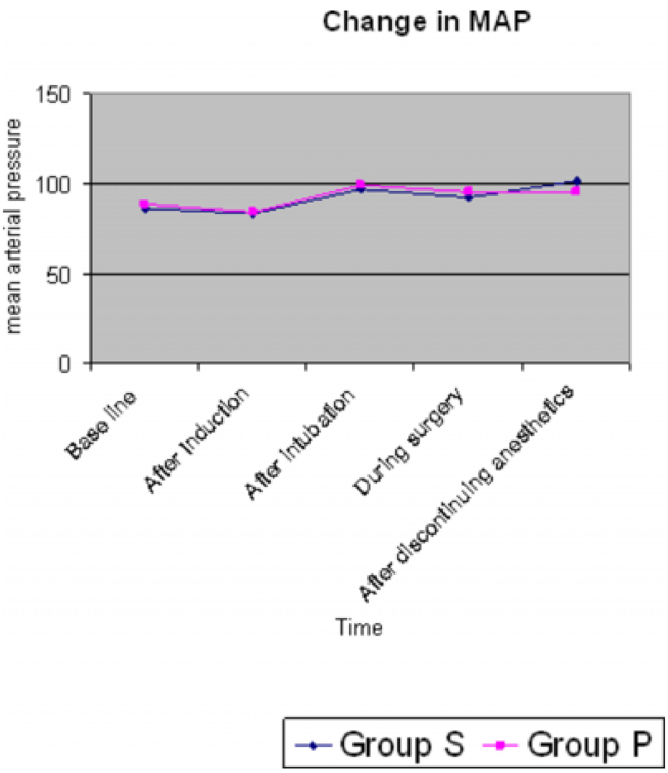

Figure 3

Graph 2: Change In Heart Rate

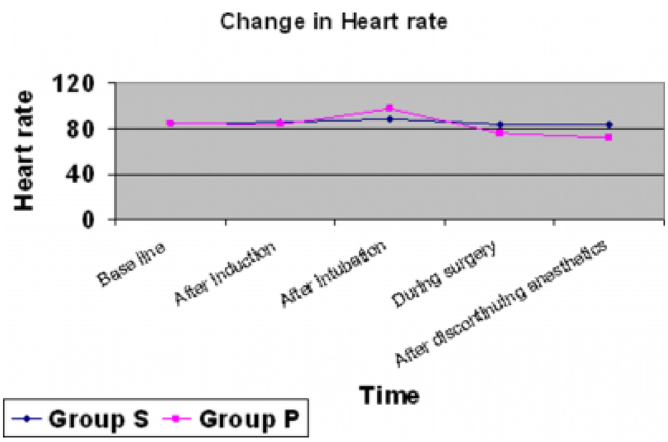

Figure 4

Table 2: Change in HR and MAP in two groups (mean ± SD)

Parameter	Group S (n=15)	Group P (n=15)
Heart rate		
Base line	86.5 ± 5.0	89 ±3.4
After induction	83.4 ±3.2	84.4 ±2.6
After intubation	97 ± 3.5*	99.3 ± 4.4*
During Surgery	92.7 ± 3.7*	95.2 ± 2.6*
After discontinuing anesthetics	101.3 ± 3.8*	95.3 ± 4.3*
Mean arterial pressure		
Base line	84.4 ± 504	84.6 ± 5.1
After induction	86.2 ± 4.1	8309 ± 4.6
After intubation	89 ± 4.8*	97.2 ± 4.8
During Surgery	83.8 ± 5.3	76.5 ± 5.8*
After discontinuing anesthetics	83.8 ± 2.5	72.5 ± 3.0*

* Significant compared to base line value.

Figure 5

Table 3: Intraoperative drug consumption (mean ± SD)

Drugs	Group S (n=15)	Group P(n=15)
Thiopentone (mg)	235 ± 29.3	232 ± 26.4
Fentanyl (mcg)	124 ± 30.2	123 ±27.1
Propofol 1%(ml)		756 ± 65.2
Sevoflrane (ml)	44.4 ± 3.7	
Ringer lactate (ml)	1230 ± 74.3	1244 ± 75.4

Patient maintained on sevoflurane based anesthesia were extubated at an earlier stage (9.5 ± 4.7 minutes vs. 16.5 ± 4.6 minutes) than those maintained with propofol infusion. The time to eye opening (7.9 ± 3.9 minute vs. 16.8 ± 6.8) and hand squeezing (8.7 ± 3.4 minutes vs. 14.5 ± 7.3 minutes) were also shorter in Group S compared to Group P (Table IV, Graph III). On emergence the behavioral score in both the group doesn't differ much (Table IV) except that more patients in Group P were drowsy 93 vs. 1) and one patient in Group S was restless.

Figure 6

Graph 3: Recovery Characteristics

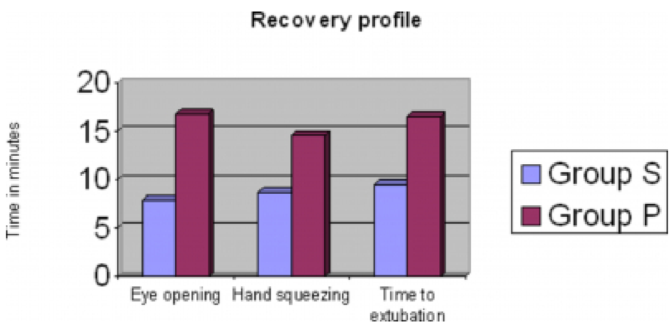

Figure 7

Table 4: Anesthetic effects on interval in minutes from cessation of anesthetics to eye opening, hand squeezing, time to extubation and level of consciousness on emergence (mean ± SD).

Recovery profile	Group S (n=15)	Group P(n=15)
Eye opening	7.9 ± 3.9	16.8 ± 6.8*
Hand squeezing	8.7 ± 3.4	14.5 ± 7.3*
Time to extubation	9.5 ± 4.7	16.5 ± 4.6*
Behevioural score	Number of patients	
1	8	7
2	1	3
3	1	0
4	0	0

* Significant compared to propofol group.

DISCUSSION

Early extubation after spinal surgery certainly appears to be in most of surgeries in adult patients. The conduct of anesthesia is more complex when planned for early extubation. Among the various factors determining early extubation, the drug distribution and maintenance of anesthesia plays a major role.

The maintenance phase of general anesthesia is that time from the initial establishment of surgical anesthesia, the end of induction to the time of decreasing the anesthetic depth to allow the patient to awaken at the end of surgical procedures. The goals are to provide stable hemodynamics, adequate analgesia and anesthesia.

Propofol an intravenous anesthetic characterized by rapid metabolic clearance has been used extensively in day care anesthesia for smooth maintenance and rapid recovery. The report states that during maintenance of anesthesia with propofol infusion there is a 20-30% decrease in systolic blood pressure from the preinduction value (3,7).But the heart rate may either increase (8), decrease (9) or remain unchanged (10).Increasing the infusion rate of propofol produces a slightly greater decrease in arterial blood pressure (7). This property of propofol helps in controlling the transient hypertensive response to noxious surgical stimuli during intraoperative period.

Sevoflurane an inhalational anesthetic of ethereal origin with low solubility in blood and body tissue has gained popularity in the recent years because it facilitates rapid induction and recovery (2,11). Wondell C etal (11) reported that following general anesthesia, extubation is earlier in patients who received sevoflurane for maintenance than those maintained on propofol infusion. He also reported that patients regained cognitive function much earlier after sevoflurane anesthesia.

In our study sample the intraoperative hemodynamic parameter viz. heart rate and blood pressure were with in acceptable range in both the groups. Although both the drugs effectively counteracted transient hypertensive response to noxious surgical stimuli like skin incision, we found that sevoflurane was more effective to do so with shorter dose increase and dose decrease period. On emergence from anesthesia the behavioral score does not differ much in both the groups. As both the groups are in homogeneous in respect to age, sex, weight, type and duration of surgery, we assumed that this change in hemodynamics was related to the anesthetic technique. Patient with sevoflurane group are oriented and required post operative analgesia much earlier than propofol group.

Sevoflurane like any other inhalational anesthetics is associated with postoperative nausea and vomiting (PONV)([12]) where as the incidence of PONV is less in propofol based anesthesia because of its intrinsic antiemetic property([13]).Apfel etal ([13]) in his series states that this difference between propofol and volatile anesthetics is caused mainly by the emetogenic effects of volatile anesthetics and not by antiemetic property of propofol.in this study sample only one patient in sevoflurane group experienced nausea but we think our study sample is too small to comment on this aspect.

CONCLUSION

The observations revealed that maintenance of anesthesia with sevoflurane is associated with a faster recovery than propofol anesthesia. But in a pharmacoeconomic based approach the increased cost of sevoflurane has to be linked with the benefit of rapid emergence.

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