Comparison of Propofol Based Anaesthesia to Conventional Inhalational General Anaesthesia for Spine Surgery

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ABSTRACT

Background: Often conventional Inhalational agents are used for maintenance of anaesthesia in spine surgery. This study was undertaken to compare propofol with isoflurane anaesthesia with regard to haemodynamic stability, early emergence, postoperative nausea and vomiting (PONV) and early assessment of neurological functions.

Patients & Methods: Eighty ASA grade I &II adult patients were randomly allocated into two groups. Patients in study group received inj propofol for induction as well as for maintenance along with N_2O+O_2 and the control group patients received inj thiopentone for induction and N_2O+O_2+isoflurane for maintenance. BIS monitoring was used for titrating the anaesthetic dose adjustments in all patients. All patients received fentanyl boluses for intraoperative analgesia and atracurium as muscle relaxant. Statistical data containing haemodynamic parameters, PONV, emergence time, dose of drug consumed & quality of surgical field were recorded and compared using student t' test and Chi square test.

Results: The haemodynamic stability was coparable in both the groups. The quality of surgical field were better in study group. Though there was no significant difference in the recovery profile (8.3% Vs 9.02%) between both the groups , the postoperative nausea and vomiting was less in propofol group than isoflurane group (25%Vs60%). The anaesthesia cost was nearly double for propofol than isoflurane anaesthesia.

Conclusion: Haemodynamic stability was comparable in both the groups. . There was no significant difference in the recovery time between intravenous and inhalational group. Patients in propofol group were clear headed at awakening and were better oriented to place than inhalational group.

KEYWORDS: Propofol, Isoflurane anaesthesia, spine surgery.

Total intravenous anaesthesia is the latest step in the evolution of concept of balanced anaesthesia which obviates the need for an inhalational agent.[1] Interest in total intravenous anaesthesia (TIVA) has risen due to advent of propofol, the kinetics of which allows both induction and continuous intravenous maintenance of anaesthesia with rapid recovery of consciousness.[2] Propofol has been shown to be superior to inhalational anaesthesia in terms of rapid awakening and return of street fitness. Early awakening aids in performing neurological examination in the early post operative period. The standard use of halothane or isoflurane doesn't allow quick assessment of these patients following their use. Moreover, the use of TIVA avoids local and global pollution seen with inhalational anaesthetic agents.[3]

The aim of this study is to compare propofol based anaesthesia with isoflurane based anaesthesia in spine surgeries.

MATERIAL AND METHODS

After obtaining clearance from the Institutional ethical committee and taking an informed consent, eighty adult patients of ASA grade I and II undergoing spine surgery were randomly (by computer generated random numbers) allocated into two groups. All patients received inj. glycopyrolate I.M. (4 μg kg^{-1}) 45 minutes before operation as the procedure was done in prone position. No antiemetic was given as premedication.

Patients in the study (intravenous) group were induced with BIS guided injection of inj. propofol to have a BIS value of about 50 and were maintained with continuous infusion of inj. propofol to have a BIS value between 40 to 60 throughout the procedure along with N_2O+O_2. The propofol infusion was tapered towards the end of the surgery and it was stopped at the end of skin closure.

Patients in the control (inhalational) group were induced with inj. thiopentone (4-5 mg kg^{-1}) in a titrated manner until loss of eyelash reflexes and were maintained with N_2O+O_2+ isoflurane inhalation to have a BIS value within 40-60. Isoflurane was also tapered towards the end of surgery and stopped at skin closure. N_2O was discontinued during wound dressing.

Muscle relaxation was achieved in both groups with inj. atracurium (0.5 mg kg^{-1}) for intubation and intermittent dose of inj. atracurium (0.1 mg kg^{-1}) was given to have 75%-90% neuromuscular blockade during maintenance. Analgesia was achieved with inj. fentanyl (2 μgm kg^{-1}) at induction and inj. fentanyl 1 μg kg^{-1} thereafter every 1 hr. At the end of surgery neuro muscular blockade in all patients was reversed with

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inj.neostiogmine (50µgm kg^{-1}) & inj glycopyrrolate (10µg kg^{-1}).

Intraoperative hypotension was managed with fluid bolus and inj. phenylephrine 50µg boluses. Hypertension was managed by deepening anesthetic depth or analgesia or both. Recovery time was recorded from cessation of infusion or inhalational agent to eye opening on command, head lift on command and achievement of Aldrete score=9.

The quality of surgical field was assessed by the operating surgeon and graded as good/satisfactory/fair/unsatisfactory. The surgeon was blinded to the the anaesthetic technique used. For the purpose of analysis, the first two grades were considered acceptable for surgery and the latter two were considered unacceptable.

Table 1
Aldrete score

Parameters	Score
ACTIVITY (able to move voluntarily or on command)	
Moving all 4 extremities	2
Moving 2 extremities	1
Not able to move any extremity	0
RESPIRATION	
Able to deep breathe and cough freely	2
Dyspnea, shallow or limited breathing	1
Apnea	0
CIRCULATION (SBP)	
SBP ± 20 mm of Hg of pre anaesthetic level	2
SBP ± 20-50 mm of Hg of pre anaesthetic level	1
SBP ± 50 mm of Hg of pre anaesthetic level	0
LEVEL OF CONCIOUSNESS	
Alert	2
Drowsy but reusable on calling	1
No response	0
COLOUR	
Normal	2
Pale or dusky	1
Cyanotic	0

ECG, HR, NIBP, capnography and pulse oxymetry were monitored intra-operatively in all patients. The heart rate and mean arterial pressure were recorded every minute beginning from just before induction until surgical incision and every 10 minutes thereafter, throughout the surgery.

Total dose of propofol and isoflurane consumed during the procedure was noted. The two groups were compared in relation to hemodynamic alteration, surgeons opinion about surgical field, recovery time and quality, post operative nausea and vomiting and cost of propofol/isoflurane used using student t' test and Chi square test.

The data collected was analysed statistically using student t' test and Chi square test.

RESULTS

There were no significant differences in age, weight, sex and duration of surgery between patients of the two groups.

The heart rate in both the groups increased following induction and incision. Intra-operatively the heart rate remained >20% below baseline value in the study group. However, in these patients the heart rate was almost same as before induction in the inhalational group patients.

The incidence of hypotension (mean BP < 80 mmHg) was almost same in both the groups being (4out of 40 patients) in intravenous group and (3 out of 40 patients) in the inhalation group.

The quality of surgical field as stated by surgeon was acceptable in 32/40 (80%) patients in study group as compared to 20/40 (50%) patients in control group which is statistically significant (Table 2).

Table 2
Comparison of surgical field conditions

Field conditions	Study group (n = 40)	Control group (n = 40)
Acceptable (good+ satisfactory)	32 (80%)	20 (50%)
Not acceptable (fair+ unsatisfactory)	08 (20%)	20 (50%)

The recovery profile was adjudged by time to eye opening, extubation, head lift and aldrete score = 9 from cessation of anaesthetic agents. Patients were asked about orientation to time, place and person. There was no significant difference in the recovery time between intravenous and inhalational group. But patients in propofol group were clear headed at awakening and were better oriented to place than inhalational group.

Table 3
Recovery parameters

Parameters	Study group	Control group
Time to eye opening (mean ± SD)	8.43 ± 2.22	9.02 ± 2.54
Time to extubation	9.25 ± 2.44	9.42 ± 3.01
Time to limb lift	12.44 ± 3.45	13.11 ± 3.20
Time to have aldrete score =9	14.33 ± 3.26	15.02 ± 3.39

The cost of isoflurane used for the case was calculated by averaging the total cost of isoflurane used for 10 to 12 patients when the isoflurane vaporizer was completely filled with 250 ml of isoflurane. The cost of propofol used in the case was calculated by noting the total propofol used both during induction and maintenance. On an average 400 mg of propofol was required which cost about 400 rupees. But it required nearly 20 ml of isoflurane costing about 240 rupees. It doesn't take in account the cost of vaporizers infusion pump and nitrous oxide cylinder.

DISCUSSION

TIVA has led to the development of target controlled infusion (TCI) where by the anaestheiologist chooses a target blood or brain drug concentration and the microprocessor controlled infusion pump infuses the drug at the rate needed to rapidly achieve and maintain the desired concentration based on population pharmacokinetic data. On the other hand, the EEG based bispectral index (BIS) monitor has proven to be a

useful indicator of anaesthetic depth.[4]

The anaesthetic gases used for maintenance of anaesthesia have significant health hazard. Prolonged exposure to anaesthetic gases lead to drowsiness and blunting of reflexes of operating room (OT) personnel. Nitrous oxide is a green house gas and can also indirectly contribute to ozone layer depletion.[5]

Propofol is a good drug for maintenance of anaesthetic depth, as it avoids the above disadvantages of inhalational anaesthetics.[6] The pharmacokinetic profile of propofol favors its use as a continuous infusion for maintenance of anaesthesia. Early awakening is required in spine surgery to perform neurological examination in the early post operative period.[7-9] Studies have shown that propofol maintain cerebral and spinal cord blood flow autoregulation in experimental animals[10] and abolishes the metabolic endocrine stress reaction better than inhalational agents.[11]

In our study the hemodynamic profile of study group was better than control group which is also supported by the study of Price et al.[2] By providing more stable blood (and brain) concentration with a continuous i.v. infusion, it might be possible to improve the anaestheisa condition and hemodynamic stability as well as decreasing side effects and recovery times with i.v. anaesthetics. We did not find any statistical differences in recovery time for eye opening, extubation time, limb lift and Aldrete scores between groups.

However, the operating surgeons who were blinded to anaesthetic procedure, reported superior quality of surgical field with propofol infusion. Pavlin et al[12] and Eberhart et al[13] also demonsrated superior surgical field with propofol in sinus surgery. This may be due to steady state plasma level of propofol achieved by continuous i.e. infusion providing relatively low BP, resulting into less blood loss and lesser surgical field congestion.[14]

In the post operative period only 22% of patients of intravenous group complained of nausea and vomiting as compared to 60% of patients of inhalational group. Propofol appears to possess antiemetic property that contributes to lower incidence of emetic sequel after GA. In fact, subanaesthetic dose of propofol (10 to 20 mg) has also been successfully used to treat nausea and vomiting in the early post-operative period.[15] This is due to its antidopaminergic activity and depressant effect on CTZ.

Without considering for the equipment costs (costs of vaporizer, infusion pump and N_2O-cylinder) the cost in propofol group was nearly double than that of isoflurane group in our study. Thus the anaesthesiologist has to consider whether the added cost is worth the advantages in a given situation.

In conclusion total intravenous anaesthesia with propofol provides better recovery with clear headedness for early neurological assessment for spine surgery. Moreover, this technique is also helpful in achieving an eco-friendly environment around the operating area.

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