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ORIGINAL RESEARCH

COMPARISON OF INTRAOPERATIVE HAEMODYNAMIC PARAMETERS AND COST EFFECTIVENESS BETWEEN SEVOFLURANE (INHALATIONAL) ANAESTHESIA AND PROPOFOL (TIVA) BASED ANAESTHESIA

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ABSTRACT

Introduction: Loss of blood in any type of surgery caused by many reasons. It is not only due to surgical procedures or anaesthesia related methods. It can be reduced due to various methods out of which maintaining hypotension is most common. For this purpose, combination of nitroprusside or esmolol drips and various other anaesthetic drugs can be used.

Aims and Objectives: The present prospective and comparative study was conducted to compare the intraoperative haemodynamic parameters and cost effectiveness between sevoflurane (inhalational) anaesthesia and propofol (TIVA) based anaesthesia. Material and

Methods: Present prospective comparative study was carried out in the Department of Anaesthesiology and Critical Care, World College of Medical Sciences & Research Hospital Girawar, Jhajjar, Haryana (India). A total of 40 patients were included who were further divided into two groups of 20 each with age range of 20-60 years. Patients were graded according to ASA I-II.

Results: Mean age of the patients in group S was 38.11±9.28 and in group P, it was 41.27±10.12 years. A total of 16 patients were male and 4 were female in group S. Similarly, in group P, we found 18 male and 2 female. Mean body mass index in group A was 23.25±4.18 and in group P, it was 26.32±8.18 (kg/m^2). A total of 14 patients in group S and 16 in group P had ASA grade I. Similarly, ASA grade II was observed in 6 patients of group S and 4 patients of group P ($p > 0.05$). Mean induction time was 53.25±6.75 in group S and 62.21±9.19 seconds in group P ($p < 0.001$). MAP at baseline was 101.5±4.18 in group S which decreased to 98.2±5.87 before induction and thereafter to 91.4±4.54 after induction. After 1 minute of induction it was 93.2±3.28, after 5 minute 98.2±4.87, at 10 minutes 99.4±5.28, 20 minutes 99.9±6.28, 30 minutes 102.2±4.28, at 40 minutes 103.4±3.18, after 50 minutes 104.2±4.28 and finally after 60 minutes it was 103.2±3.28. Similarly, in group P, mean arterial pressure was higher at baseline. It was 104.7±5.98, decreased to 97.9±6.58 before induction and thereafter to 87.2±4.92 after induction. After 1 minute of induction it was 90.2±3.92, after 5 minute 96.1±292, at 10 minutes 93.1±2.94, 20 minutes 94.1±4.92, 30 minutes 99.1±3.12, at 40 minutes 98.1±5.92, after 50 minutes 97.4±5.92 and finally after 60 minutes it was 99.1±6.92. Eye opening mean values was 10.5±2.3, verbal communication 12.4±2.2 and mental orientation was 17.4±1.9 in group A. In group P, it was 14.2±2.8, 15.6±3.2 and 22.2±3.2, respectively ($p < 0.001$ Significant). Mean cost of anaesthesia in group S was 412.25±95.14 Indian rupees (INR) and in group P, it was higher i.e. 504.85±101.20. Total cost including wastage was 625±104.24 in group S and higher in group P i.e. 750.84±212.45.

Conclusion: We concluded that cost of sevoflurane is less as compared to propofol. We further found that haemodynamic effects of both is comparable.
Keywords: Intraoperative, Haemodynamic, Cost Effectiveness, Sevoflurane, Propofol, Anaesthesia

INTRODUCTION

When a anaesthesiologist select a particular anaesthetic agent for a specific surgery, its efficacy, pharmacokinetic profile &cost effectiveness always plays a important role. Most common practice adopted by any anaesthesiologist is that they prefer those anaesthetic agents with which they are familiar or they have proper knowledge about its safety, efficacy and they don't give too much consideration related to its cost effectiveness etc. Numerous factors are responsible to decrease the cost of anaesthesia which include operative conditions, standard protocol, aseptic conditions, and restriction on money-minded system among few medical professionals keeping in view the best patient care in the recent era.[1,2]

During the literature survey regarding cost effectiveness, we observed a comparison between total intravenous (IV) anesthesia and inhalational anesthesia prominently by direct cost measurements, which lead to a mis-interpretation.[3,4] There are various methods to calculate costs of the drugs i.e. average use of dose or its flow rate, wastage of drugs, gas flow exchange rate, consumables cost and duration of anaesthesia.[5,6] In nutshell, we can say that cost effect also balance the cost of an anesthetic drug along with its pharmacodynamics effects i.e. efficacy, dose required and recovery profile of the patient.

Use of sevoflurane was reported in the seventh decade of 19th century, but it was released for clinical use in early 1990s. In the recent era, due to its minimal side effects on different organ system made it a choice of drug throughout the world due to its pharmacodynamic and pharmacokinetic properties. It is found to be a good option due to safety and reliability as an anaesthetic agent in clinical practice. In recent decades, use of general anesthesia reported improvements and modifications in vast and even in the recent era, new modification in the form of total intravenous anesthesia (TIVA) has also undergone numerous improvements since its introduction into the clinical practice.[7,8]

Keeping in view the above mentioned facts, the present prospective, randomized study was conducted to compare intraoperative haemodynamic parameters and cost effectiveness between sevoflurane anaesthesia and propofol based anaesthesia.

MATERIAL AND METHODS

The present prospective comparative study was carried out in the Department of Anaesthesiology and Critical Care, World College of Medical Sciences & Research Hospital Girawar, Jhajjar, Haryana (India). A total of 40 patients were included who were further sub-divided into two groups of 20 each with age range of 20-60 years. Study was conducted from Ist May 2021 to 30th October, 2021. After obtaining approval from the institutional ethics committee, 40 patients in the age group of 20 to 60 years were included. Patients were graded according to ASA I-II who were enrolled for open cholecystectomy. Finally, a total of 40 patients who fulfilled inclusion and exclusion criteria were included in the study.

Group I (n=20) Sevoflurane (S)– induction with thiopentol and maintenance with sevoflurane 1-3 MAC

Group II (n=20) Propofol (P) induction dose of 1-3 mg/kg and maintenance dose 8mg/kg/hr.

Inclusion criteria

- Patients having age between 20-60
- ASA grading I-II
- Body mass index ranged between 18.5-29.9

Exclusion criteria

- Refusal to sign informed consent
- Ischemic heart disease or any other cardiac disease
- Patients taking any type of beta blockers, anticonvulsant or psychotropic drugs
- Patients with HR < 50/min or having hypotension during study

Methodology

The present study was carried out after obtaining approval from institutional ethical committee and written informed patient consent was obtained from all the patients. The anesthetic procedure was clearly explained to all the patients in their own / local language followed by written consent. Before start of anaesthetic procedure, a clinical patient's information proforma filled.

All the 40 patients were evaluated. Demographic profile and clinical record of all the patients were noted of both the groups. Patients were included in the study randomly by using computerised randomization and they were divided into two groups: Group S: Sevoflurane group, and Group P: Propofol group.

All patients were instructed to kept themselves fasting for a minimum of 8 hours before the start of surgical procedure. Before start of anaesthetic procedure, initially Tab. Alprazolam and Injection Ranitidine were given early morning i.e. day of surgery. Five lead electrocardiogram, non-invasive blood pressure, SpO2 and various other baseline parameters were recorded. Induction with propofol was carried out. Blood pressure was noted immediate before start of induction of anesthesia and followed by every 10 minutes. In all the patients, muscle relaxation was used by intermittent boluses of atracurium (0.02 mg/kg). In the end of surgery, we started infusion of either Sevoflurane or Propofol when the skin sutures were being applied. Continuous monitoring of hemodynamic variables was seen.

Various baseline parameters such as pulse rate (PR), systolic blood pressure (SBP), diastolic blood pressure (DBP), mean arterial pressure (MAP), oxygen saturation (SpO_2) were recorded at different time intervals ranging from 10 minutes during surgery to 2 hours.

Statistical analysis

At the end of the study, data was collected and analysed statistically. For qualitative data, Chi-square test was used. For mean comparison between two groups, independent t-test was used. A p value of <0.05 was considered as statistically significant.

RESULTS

The present prospective study was carried out in in the Department of Anaesthesiology and Critical Care, World College of Medical Sciences & Research Hospital Girawar, Jhajjar, Haryana (India) after obtaining approval from institutional ethical committee. Informed written consent was obtained from all the patients before inclusion into the study. The enrolled patients who fulfilled the inclusion and exclusion criteria were further subdivided into two groups (n=20) in each group.

Table I: Demographic parameters of the study population

Parameters	Group S (n=20)	Group P (n=20)	Statistical significance
Age	38.11±9.28	41.27±10.12	0.309 (>0.05 NS)
Sex (Male/Female)	16/4	18/2	0.784 (>0.05 NS)
Body mass index (kg/m^2)	23.25±4.18	26.32±6.18	0.07(>0.05 NS)
ASA (I/II)	14/6 (70%/30%)	16/4 (80%/20%)	0.533 (>0.05 NS)
Heart rate (bpm)	74.88±3.24	76.21±4.27	0.274(>0.05 NS)

SBP (mmHg)	126.12±11.15	132.22±13.18	0.122(>0.05 NS)
DBP (mmHg)	77.75±4.23	78.25±4.72	0.726(>0.05 NS)

In the present study, mean age of the patients in group S was 38.11±9.28 and in group P, it was 41.27±10.12 years. A total of 16 patients were male and 4 were female in group S. Similarly, in group P, we found 18 male and 2 female. Mean body mass index in group A was 23.25±4.18 and in group P, it was 26.32±8.18 (kg/m^2). A total of 14 patients in group S and 16 in group P had ASA grade I. Similarly, ASA grade II was observed in 6 patients of group S and 4 patients of group P. All these parameters among both the groups found to be statistically comparable and insignificant ($p > 0.05$).

Table II: Mean induction time (seconds)

	Group S (n=20) Mean±SD	**Group P (n=20) Mean±SD**	**Statistical significance**
Induction time (seconds)	53.25±6.75	62.21±9.19	<0.001

Table II illustrates mean induction time. It was 53.25±6.75 in group S and 62.21±9.19 seconds in group P. On statistical analysis, the difference among both the groups found to be comparable and thus statistically significant ($p < 0.001$).

Table III: Mean arterial pressure among two groups

	Group S (n=20) Mean±SD	**Group P(n=20) Mean±SD**	**Statistical significance**
Baseline	101.5±4.18	104.7±5.98	0.05 (Sig.)
Before induction	98.2±5.87	97.9±6.58	0.879 (NS)
After induction	91.4±4.54	87.2±4.92	0.007 (Sig.)
After 1 min induction	93.2±3.28	90.2±3.92	0.004 (Sig.)
After 5 min induction	98.2±4.87	96.1±2.92	0.106(NS)
After 10 min induction	99.4±5.28	93.1±2.94	0.0001(Sig.)
After 20 min induction	99.9±6.28	94.1±4.92	0.002(Sig.)
After 30 min induction	102.2±4.28	99.1±3.12	0.01(Sig.)
After 40 min induction	103.4±3.18	98.1±5.92	0.001(Sig.)
After 50 min induction	104.2±4.88	97.4±5.92	0.0003(Sig.)
After 60 min induction	103.2±3.28	99.1±6.92	0.02(Sig.)

Table III depicts mean arterial pressure among two groups. At baseline, MAP was 101.5±4.18 in group S which decreased to 98.2±5.87 before induction and thereafter to 91.4±4.54 after induction. After 1 minute of induction it was 93.2±3.28, after 5 minute 98.2±4.87, at 10 minutes 99.4±5.28, 20 minutes 99.9±6.28, 30 minutes 102.2±4.28, at 40 minutes 103.4±3.18, after 50 minutes 104.2±4.28 and finally after 60 minutes it was 103.2±3.28.

Similarly, in group P, mean arterial pressure was higher at baseline. It was 104.7±5.98, decreased to 97.9±6.58 before induction and thereafter to 87.2±4.92 after induction. After 1 minute of induction it was 90.2±3.92, after 5 minute 96.1±292, at 10 minutes 93.1±2.94, 20 minutes 94.1±4.92, 30 minutes 99.1±3.12, at 40 minutes 98.1±5.92, after 50 minutes 97.4±5.92 and finally after 60 minutes it was 99.1±6.92.

On statistical analysis, the difference among both the groups found to be statistically significant as shown in table 3 except before induction and 5 minutes after induction.

Table IV: Recovery

Parameters	Group S (n=20) Mean±SD	Group S (n=20) Mean±SD	Statistical significance
Eye opening (minutes)	10.5±2.3	14.2±2.8	0.0001 (Sig.)
Verbal communication	12.4±2.2	15.6±3.2	0.0001 (Sig.)
Mental orientation	17.4±1.9	22.2±3.2	0.0001 (Sig.)

Table IV demonstrates recovery profile of patients of both the groups. Eye opening mean values was 10.5±2.3, verbal communication 12.4±2.2 and mental orientation was 17.4±1.9 in group A. In group P, it was 14.2±2.8, 15.6±3.2 and 22.2±3.2, respectively. On statistical analysis, the difference among both the groups found to be significant (p <0.001 Significant).

Table V: Comparison of cost analysis among two groups

Parameters	Group S (n=20)	Group P (n=20)	Statistical significance
Cost of anaesthesia	412.25±95.14	504.85±101.20	0.005 (Sig.)
Total cost plus wastage	625±105.24	750.85±212.45	0.02 (Sig.)
Disposable items cost	12.15±5.14	90.15±10.20	0.0001 (Sig.)

Table V illustrates cost analysis of both the groups. Mean cost of anaesthesia in group S was 412.25±95.14 Indian rupees (INR) in group P, it was higher i.e. 504.85±101.20. Total cost including wastage was 625±104.24 in group S and higher in group P i.e. 750.84±212.45. Various type of disposable items cost found to be 12.15±5.15 in group S and 90.15±10.20 INR in group P. On statistical analysis, the difference among both the groups found to be significant.

DISCUSSION

The present prospective and comparative study was conducted to compare the intraoperative haemodynamic parameters and cost effectiveness between sevoflurane (inhalational) anaesthesia and propofol (TIVA) based anaesthesia. A total of 40 patients were included who were further divided into two groups of 20 each with age range of 20-60 years. Patients were graded according to ASA I-II. Mean age of the patients in group S was 38.11±9.28 and in group P, it was 41.27±10.12 years. A total of 16 patients were male and 4 were female in group S. Similarly, in group P, we found 18 male and 2 female. Mean body mass index in group A was 23.25±4.18 and in group P, it was 26.32±8.18 (kg/m^2). A total of 14 patients in group S and 16 in group P had ASA grade I. Similarly, ASA grade II was observed in 6 patients of group S and 4 patients of group P (p >0.05). Mean induction time was 53.25±6.75 in group S and 62.21±9.19 seconds in group P (p <0.001). MAP at baseline was 101.5±4.18 in group S which decreased to 98.2±5.87 before induction and thereafter to 91.4±4.54 after induction. After 1 minute of induction it was 93.2±3.28, after 5 minute 98.2±4.87, at 10 minutes 99.4±5.28, 20 minutes 99.9±6.28, 30 minutes 102.2±4.28, at 40 minutes 103.4±3.18, after 50 minutes 104.2±4.28 and finally after 60 minutes it was 103.2±3.28. Similarly, in group P, mean arterial pressure was higher at baseline. It was 104.7±5.98, decreased to 97.9±6.58 before induction and thereafter to 87.2±4.92 after induction. After 1 minute of induction it was 90.2±3.92, after 5 minute 96.1±292, at 10 minutes 93.1±2.94, 20 minutes 94.1±4.92, 30 minutes 99.1±3.12, at 40 minutes 98.1±5.92, after 50 minutes 97.4±5.92 and finally after 60 minutes it was 99.1±6.92. Eye opening mean values was 10.5±2.3, verbal communication 12.4±2.2 and mental orientation was 17.4±1.9 in group A. In group P, it was 14.2±2.8, 15.6±3.2 and 22.2±3.2, respectively (p <0.001 Significant). A similar study by Chaaban et al compared blood loss during

ESS in patients who received TIVA along with propofol and patients who received IA with sevoflurane. In their study, mean blood loss in TIVA group was 78.5 (14) mL/h and in the IA group 80.3 (17) mL/h. Numerical rating score (NRS) was significantly higher in the IA group as compared to TIVA group.[9]

In the present study, the intraoperative haemodynamic parameters which consists heart rate and blood pressure were comparable among the two groups ($p > 0.05$, NS). Mean cost of anaesthesia in group S was 412.25±95.14 Indian rupees (INR) and in group P, it was higher i.e. 504.85±101.20. Total cost including wastage was 625±104.24 in group S and higher in group P i.e. 750.84±212.45. A study reported by Deepak et al found sevoflurane costing higher as compared to propofol.[10]

In another similar study conducted by Bharti et al in which hemodynamic parameters were compared by using sevoflurane versus propofol anesthesia in microlaryngeal surgery. MAP was found to be significantly less after induction and increased at insertion after the use of operating laryngoscope in propofol group as compared to sevoflurane group. They further reported more patients of hypotension and hypertension in propofol group as compared to sevoflurane group but various other parameters such as emergence time, extubation time & recovery profile found to be comparable among both the groups. They concluded in their study that sevoflurane is a good option over propofol in respect of intraoperative cardiac surgeries without increasing the recovery time.[11]

CONCLUSION

Present study concluded that total cost of anesthesia found to be higher in Group P patients as compared to Group S. Mean time to extubation, eye opening, verbal commands and orientation was also lowest in Group S than Group P. Thus, we can conclude that use of sevoflurane is a good anaesthetic agents along with its cost effectiveness and recovery profile.

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