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Comparison of Recovery Profile from Propofol and Sevoflurane in Day Care Surgeries

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Abstract

Background: A prospective clinical study was done in minor Gynaecological procedures in the Department of O&G, VSSIMSAR, Burla from November 2017 to October 2019. The study compares the recovery characteristics of these two drugs and their usefulness in day care surgery.

Aims And Objective: To compare the recovery times and haemodynamic status when propofol TIVA (Total Intravenous Anaesthesia) and VIMA (Volatile Induction & Maintaince Anaesthesia) are used for the maintenance of Anaesthesia in day care surgery.

Methodology: After taking informed consent 120 patients posted for minor Gynaecological procedures of less than 30min duration (D&C, S&E, biopsy) in department of O&G, VSSIMSAR, Burla were selected randomly and divided into 2 groups, of 60 patients each. Parameter studied and data was analysed using chi square test and statistically significance was set as $P<0.05$.

Results: The two groups were similar with respect to age, weight and duration of surgery. The difference was not statistically significant. The time up to phase 1 recovery was not statistically significant between two groups but the time up to phase 2 recovery was significantly shorter in sevoflurane than propofol.

Conclusion: Sevoflurane as a sole agent had a quicker recovery and home readiness was earlier than propofol.

Keywords: TIVA, VIMA, Sevoflurane, Propofol

Introduction

Ambulatory Anaesthesia is one administered for elective surgical procedure performed on carefully selected patients, which is undertaken with all its constituent elements (admission, surgery and discharge home) on the same day. It is also referred to as day case, day care or outpatient anaesthesia and more recently office - based anaesthesia. Ambulatory anaesthesia is a rapidly growing subspecialty. Although its history is as old as the history of general anaesthesia itself, it has emerged as a recognized concept and is evolving over the past couple of decades.

The principal arguments in favour of this practice are minimizing cost and making hospital resources available for more number of patients, as each patient

spends a shorter period in the hospital. A shorter stay in the hospital also means lesser disruption in the regular activities of the patient and his relatives and lesser chances of nosocomial infections. It also decreases the patients separation from their familiar home environment making it preferable to the children and elderly. The availability of shorter acting anaesthetic agents with better recovery profile has made general anaesthesia applicable in day case procedures. The 'clear headedness' of recovery enables the patients to be discharged from the hospital just a few hours after surgery. The drugs found most suitable for this technique are propofol and sevoflurane. The present study compares the recovery characteristics of these two drugs and their usefulness in ambulatory anaesthesia.

Inhalational anaesthesia techniques remain the mainstay of modern anesthesia practice. It is believed that inhaled anaesthetic technique allows rapid emergence from anesthesia, probably because of ease of titratability, and exerts some neuromuscular blocking effect, which may reduce the requirements of nondepolarizing muscle relaxants. Sevoflurane, a newer shorter-acting inhaled anaesthetic offer the potential for rapid recovery from anesthesia. However, with the introduction of propofol and newer delivery systems (e.g., target-controlled infusion), there is increased interest in total intravenous anesthesia (TIVA). Titrating anaesthetic agent's delivery by bispectral index (BIS) monitoring during general anesthesia in adults allows the anaesthetists to adjust the amount of anaesthetic agent to the needs of the patient, possibly resulting in a more rapid emergence from anesthesia. Sevoflurane has been suggested to be the long awaited, ideal inhalational anaesthetic for its properties of being pleasant smelling, relatively non-irritating to the airways and its low blood-gas solubility which allows rapid induction and recovery from anesthesia. Clinicians have taken advantage of these attributes to adopt it for volatile induction and maintenance (VIMA), especially in the day surgery setting, since it has a potential to allow 'fast-tracking' of patients.

Aims and Objective

The study compares the recovery characteristics of propofol and sevoflurane in day care surgeries.

Materials and Methods

After approval of the study by VSSIMSAR ethical committee and obtaining written informed consent, patients were randomized into two groups of 60 each i.e. Group P (propofol) and Group S (sevoflurane).

Inclusion criteria

1. Patients age 18-50 year
2. Minor gynaecologicalsurgical procedures of less than 30 minutes duration under general anaesthesia(D&C, S&E, Biopsy)
3. Non obese patients
4. ASA Grade I and II
5. Mallampatti class I, II
6. Patients had accompanying person.

Exclusion criteria

1. Patient refusal
2. Patients with a history of allergic reaction to drug that being used
3. ASA Grade III and IV
4. Patients with previous history of motion sickness, PONV.

All patients were assessed and those with normal clinical, biochemical, hematological and radiological parameters were selected. Detailed history and physical examination was carried out in all patients. Informed written consent was obtained from all patients. Nil per oral status according to rules: 2 hrs for clear fluids, 4hrs

for semisolid food, 6hrs for light meal and 8 hrs for heavy meal.

After arrival of the patient to the operation theatre, pulse-oxymeter, non-invasive blood pressure (NIBP), ECG and BIS monitors were connected. The baseline heart rate, systolic blood pressure, diastolic blood pressure and mean arterial pressure were recorded. A suitable intra venous line was secured and a pre loading was done with500 ml of Ringer's lactate solution.

All patients were premeditated with IV Glycopyrrolate 5µg/kgIV and nalbuphine 0.3mg/kg 15min before induction.

All patients were pre-oxygenated with 100% oxygen for 3min.

Patients were randomly divided into two groups

GROUP – P (Propofol group)

GROUP – S (Sevoflurane group)

Group -P (Propofol group)

In propofol group patients two IV lines were secured, one for propofol infusion and other for normal ringer lactate crystalloid infusion. Intravenous Ringer lactate crystalloid was given according to holidays segar rule (4:2:1 rule) in the intraoperative period. The patients were induced with propofol 2mg/kg IV bolus. When BIS reached to 40, appropriate sized I-gel was introduced and position of I-gel was confirmed. In case of any movement when observed, an additional bolus of 0.5 mg/kg was given. Immediate after induction, this group patients were received a continuous infusion of propofol from a B-Braun Melsungen syringe pump @ 150 to 250 µg/kg/min and BIS was kept in between 40 to 60. After confirming and securing the I-gel in position, they were connected to the closed circuit with maintained with nitrous oxide and oxygen in 2L: 1L ratio. The patients were kept on spontaneous ventilation throughout the procedure, in between during surgery any movement by the patients were tackled with a 20 mg of bolus of propofol. No muscle relaxants were used.

Group-S (Sevoflurane group)

The patients were induced with sevoflurane at a concentration of 0.5%, then gradually increased till BIS reached to 40 by patient controlled inhalation induction i.e. spontaneous ventilation (Penlon sigma Delta vaporizer) in Nitrous Oxide and oxygen in 4L: 2L ratio. When BIS reached to 40, appropriate sized I-gel was introduced and position of I-gel was confirmed. After confirming and securing the I-gel in position, they were connected to the closed circuit with nitrous oxide and oxygen in 2L: 1L ratio with sevoflurane 2% to maintain BIS in between 40 to 60. The percentage of Sevoflurane was titrated in 0.5% increments or decrements according to patients response and to maintain BIS in between 40 to 60. Intravenous Ringer lactate crystalloid was given according to holidays segar rule (3:2:1 rule) in the intraoperative period .The patients were kept on spontaneous ventilation throughout the procedure. No muscle relaxants were used.

Monitoring

Throughout the procedure, HR, ECG,BIS and SPO_2 were monitored continuously andNIBP was monitored every 5 minutes.

Recovery

In both groups, the maintenance agent was discontinued once the vaginal speculum was removed. The time of discontinuing the agent was taken as "time zero" to calculate the recovery time. The patients were ventilated with 100% O_2 at a flow rate of 5L/min until BIS reached to 80 and then I-gel was removed.

Parameters studied

1. **Induction Time**

Time interval from the start of induction to BIS reached to 40.

2. **Induction Complications**

1. Desaturatin
2. Coughing
3. Laryngospasm
4. Patient movement

3. **Incidence of Apnoea**

4. **Time To Phase I Recovery**

This is the time taken from discontinuation of propofol or sevoflurane to the time when Aldrete score is ≥ 9. After Aldrete score reached ≥ 9 patients were allowed to shift from OT to ward.

5. **Time To Phase Ii Recovery**

This is the time taken from discontinuation of propofol or sevoflurane to the time when the PADSS score is ≥ 9. It is also taken as the time to home readiness.

Statistical analysis

The descriptive statistics of the variables studied are represented as two-way tables. The categorical factors are represented by the number and frequency (%) of cases. The continuous variables are represented by measures of central frequency (like mean, median) and deviation (standard deviation and range). Parametric datais analysed using paired and non-paired t-tests with Bonferoni corrections for multiple comparisons. Discrete data is analysed using chi-square. All values are represented as mean (SD) with statistical significance determined at P value less than 0.05.

Observations and Results

Table 1: Distribution of age (years) of cases by groups

Age	Group P	Group S	p-value*
No. of cases Mean	60 30.65	60 31.32	0.276
S.D. Median Range	2.399 30 27 – 38	2.259 31 27 – 38	

*Not statistically significant

Table 2: Distribution of weight(kgs) of cases by groups

Weight	Group P	Group S	p-value*
No. of cases Mean S.D. Median Range	60 44.32 2.613 45 39 – 50	60 46.38 3.945 45.50 39 – 55	0.252

*Not statistically significant

Table 3: Distribution of cases by ASA and groups

ASA	Group P (n=60)		Group S (n=60)		p-value*
	No.	%	No.	%	
Grade I	47	78.33	52	86.66	
Grade II	13	21.67	8	13.34	0.230
Others	0	0.0	0	0.0	

* Not statistically significant

Table 4: Distribution of time (in second) to LOC by groups (time to reach BIS 40)

Time to LOC (in second)	Group P	Group S	p-value*
No. of cases	60	60	
Mean	68.62	103.27	
S.D.	3.715	4.230	<0.001*
Median	67	104.50	
Range	64 - 80	96 - 110	

*Statistically significant

The mean time to LOC was observed to be lesser in Group P than Group S and the difference was statistically significant (p<0.001).

Table 5: Distribution of Cases By Groups and Map (Mm Hg)

MAP	Group P *(n=60)*	Group S *(n=60)*	p-value
PRE-OP Mean SD	92.08 4.597	91.68 3.766	0.230
AT INDUCTION Mean SD	74.22 8.322	83.45 7.956	0.347
POST-OP Mean SD	84.67 4.977	84.63 7.185	0.003
AT DISCHARGE Mean SD	91.70 4.327	90.28 3.253	0.074

* Not statistically significant

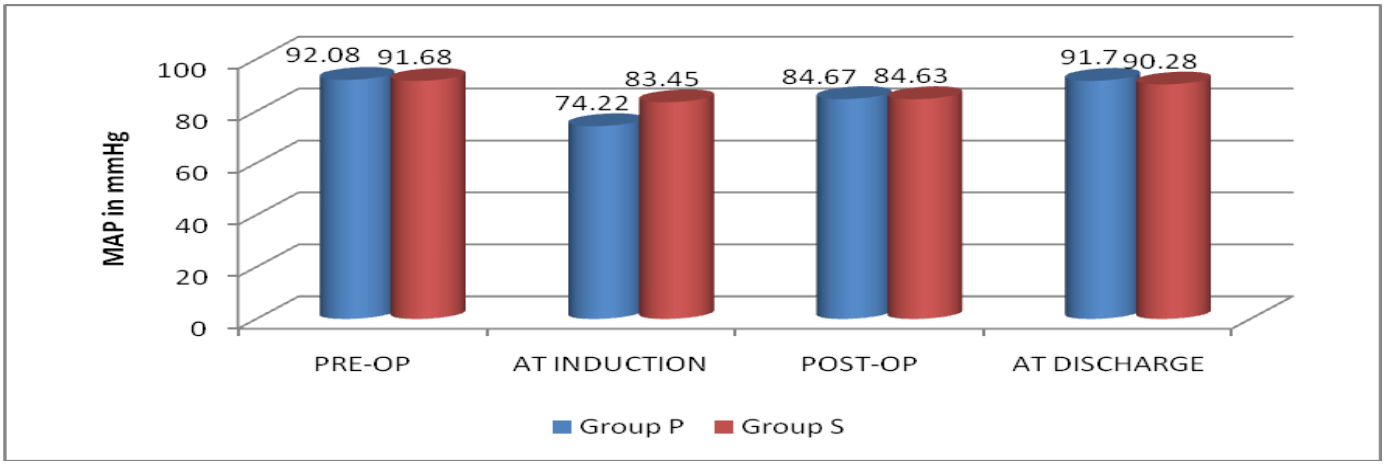


Table 6: Distribution of Cases By Groups And Pulse Rate (Per Minutes)

Pulse rate	Group P *(n=60)*	Group S *(n=60)*	p-value
PRE-OP Mean SD	84.70 6.323	82.90 7.780	0.500
At induction Mean SD	72.07 7.653	75.60 7.563	0.016*
POST-OP Mean SD	80.17 6.528	78.27 5.590	0.117
At discharge Mean SD	85.00 6.651	83.43 7.263	0.688

* Statistically significant

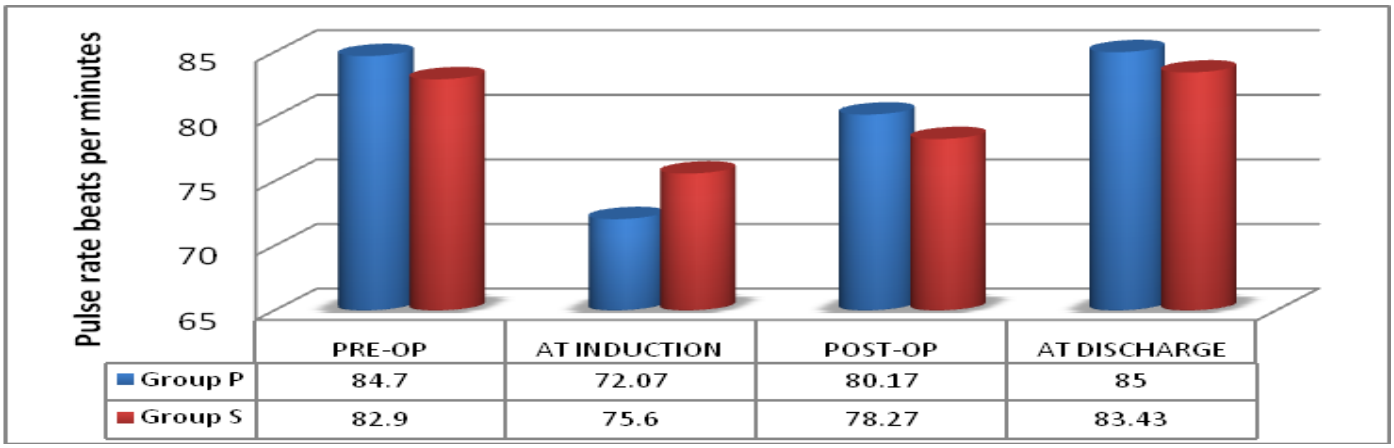


Table 7: Duration of Anaesthesia (mins)

Duration of anaesthesia (mins)	Group P	Group S	p-value*
No. of cases	60	60	
Mean	19.07	19.60	
S.D.	1.326	1.709	0.715
Median	19.00	19.00	
Range	16 – 22	16 - 25	

*Statistically non significant

Table 8: Duration of surgery (mins)

Duration of surgery (mins)	Group P	Group S	p-value*
No. of cases	60	60	
Mean	15.83	16.20	
S.D.	1.617	1.549	0.747
Median	16.00	16.00	
Range	11 - 19	12 – 20	

*Statistically non significant

Table 9: Distribution of Cases by Incidence of Apnoea And Groups

Apnoea	Group P (n=60)		GroupS (n=60)		p-value*
	No.	%	No.	%	
No	28	46.66	60	100.0	<0.001
Yes	32	53.34	0	0.0	

*Statistically significant

In Group P 53.34% patients at apnoea while 46.66% patients did not have apnoea but in Group S patients didn't have any apnoea.

Table 10: Distribution of Phase I recovery (in minutes) by groups

Phase I recovery profile	Group P	Group S	p-value*
No. of cases	60	60	
Mean	11.92	12.25	
S.D.	0.996	1.099	0.084
Median	12	12	
Range	10 - 15	11 - 15	

* Statistically non significant

The distribution of Phase I recovery profile between Group P (11.92± 0.996 minutes) and Group S (12.25±1.099 minutes) was statistically non-significant (p> 0.05).

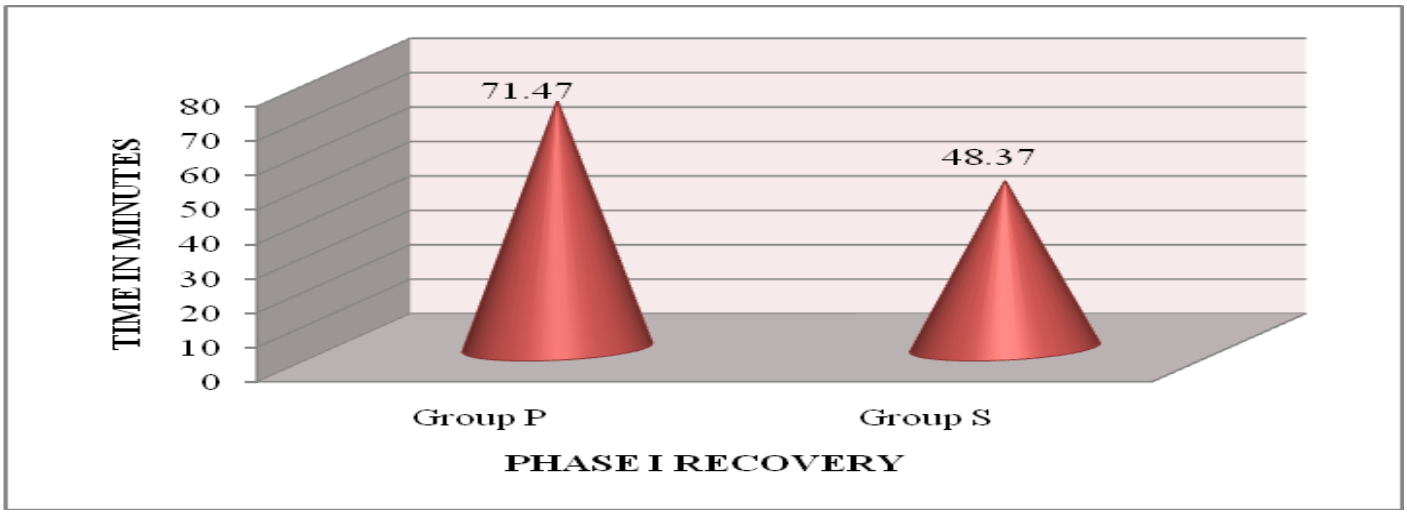
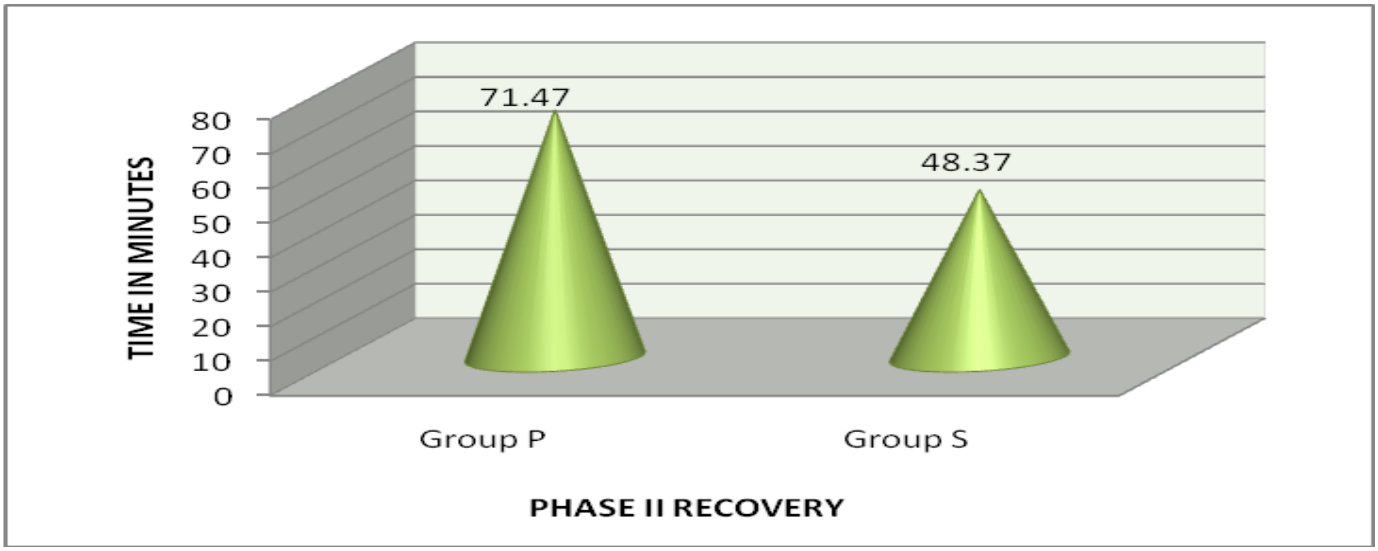


Table 11: Distribution of phase II recovery (in minutes) by groups

Phase II recovery profile	Group P	Group S	p-value*
No. of cases	60	60	
Mean	71.47	48.37	
S.D.	3.959	2.617	<0.001
Median	70	48	
Range	65 - 80	44 - 54	

*Statistically significant

The mean time of Phase II recovery in Group P was 71.47 ± 3.959 minutes where as in Group S it was 48.37 ± 2.617 minutes. P value was <0.05, so there was statistically significant difference in the phase II recovery between Group P and Group S.



Discussion

Intravenous agents are used commonly for induction of anaesthesia followed by inhalational agents for maintenance. A problem with this technique is the transition phase from induction to maintenance. The rapid redistribution of the intravenous agent could lead to lightening of anaesthesia before an adequate depth is attained with the inhalational agent. This has promoted the rediscovery of 'single agent' anaesthesia, which avoids problems associated with a transition phase.[40]

Propofol is a short acting general anaesthetic agent used widely for total intravenous anaesthesia because of its favourable recovery profile and low incidence of side effects. Propofol infusions are also becoming increasingly popular for maintenance of anaesthesia. However, use of propofol is associated with pain on injection, cardiovascular and respiratory depression and requires an intravenous drug delivery system.

Sevoflurane is a safe and versatile inhalational anaesthetic compared with currently available agents. Sevoflurane is useful in adults and children for both induction and maintenance of anaesthesia in inpatient and outpatient surgery. Of all currently used anaesthetics, the physical, pharmacodynamic, and pharmacokinetic properties of sevoflurane come closest to that of the ideal anaesthetic. These characteristics include inherent stability, low flammability, non – pungent odour, lack of irritation to airway, low blood: gas solubility allowing rapid induction of and emergence from anaesthesia, minimal end-organ effects, minimal effect on cerebral blood flow, low reactivity with other drugs and a vapour pressure and boiling point that enables delivery using standard vapourisation techniques. [39] The availability of this agent makes it an alternative option for volatile Induction and Maintenance Anaesthesia (VIMA) [40]in day care surgeries.

A. Thwaites, S. Edmends and I. Smith in their study of inhalation induction with sevoflurane versus intravenous induction with propofol conclude that induction of anaesthesia with sevoflurane was significantly slower compared with propofol, but was associated with a lower incidence of apnoea and a shorter time to establish spontaneous ventilation. In my study incidence of apnoea was more in propofol group, but sevoflurane took a longer time to reach BIS to 40 i.e. induction time.

Reshma R Korat, Vimal G Karagatharavm, Bhavin Patel in their study on comparison of recovery profile in day care laparoscopic surgeries found that propofol caused maximum fall in BP than sevoflurane . In my study incidence of fall in BP intraoperatively more in propofol group than sevoflurane group .

Brain Fredman, MH. Nathanson, I. Smith, J. Wang, K. Klein and PF. White in their study of sevoflurane versus propofol was significantly faster than inhalation induction with sevoflurane and there were no significant difference in the incidence of coughing, airway irritation or laryngospasm during induction of anaesthesia.

In our study, we found that recovery with sevoflurane(VIMA)was quicker and associated with less haemodynamic complications than propofol(TIVA).

Results

Comparing the age, weight and ASA physical status of the patients in both the group were comparable and statistically not significant (p value >0.05).

There was definite reduction in heart rate, systolic blood pressure, diastolic blood pressure and mean after induction when compared with Pre-induction

values. However, there was no significant difference among these parameters when compared with pre-induction values in Group S patients.

Induction time is significantly lessin GroupP patients (68.62±3.71 secs) when compared with Group S patients(103.27±4.320secs),($p<0.001$)and there was no significant difference ininduction side-effects between the two groups.

Comparing the MAP in Preop , induction and discharge in the both P & S group there were no statistically significant results found . On comparing PR in both these group there were no significance between the group ,but after induction group P patients were developed bradycardia (mean 72.07 ±7.653 beats per minutes) more than group S (75.60 ±7.563beats per minutes) patients. P value was 0.016.

Duration of surgery and duration of anaesthesia were comparable in both the groups and it was statistically insignificant.

Phase I recovery in Propofol group (12.07±1.13 minutes) as compare to sevoflurane group (18.25±1.43 minutes) .but phase II recovery was much quick in sevoflurane group patients (48.37±2.61minutes) as compare to propofol group patients (71.47± 3.95minutes).

Incidence of complication like pain in injection, hypotension and bradycardia is more seen in propofol group compare to other group. But incidence of PONV, post of delirium is more in sevoflurane group.

Conclusion

On comparing the recovery characteristics of propofol and sevoflurane in day care surgeries in gynaecological procedures it was found that:

- Sevoflurane as a sole agent had a quicker recovery.
- Phase I recovery of both groups were comparable.
- Phase II recovery with sevoflurane was much shorter than propofol.
- Incidence of apnoea, hypotension is more in propofol than sevoflurane.
- Sevoflurane anaesthesia was associated with high PONV but well controlled with medications.
- Home readiness was earlier in sevoflurane than propofol.

The early phase II recovery and less complications like pain in injection, hypotension, bradycardia, aponea with sevoflurane makes it more ideal agent to use in day care surgeries.

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