

## To Compare the Recovery Characteristics of Isoflurane, Sevoflurane and Desflurane Based Anaesthesia in Patients Undergoing Laparoscopic Cholecystectomy



### Medical Science

KEYWORDS :

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#### INTRODUCTION

International Association of Ambulatory Surgery defines day-care surgery as 'An operation or procedure, an office or outpatient operation/procedure, where the patient is discharged on the same working day.<sup>1,2</sup>

Ambulatory surgery is becoming more common and not only involves simple and short surgical procedures on healthy patients but also trends towards longer procedures in infants, geriatric, and debilitated patients.<sup>3</sup> The question of how long patients should remain in hospital following ambulatory surgery before they can be discharged safely is crucial to future developments in this area of care.<sup>4</sup>

Appropriate patient selection and preparation is crucial for day surgery so as to ensure early and rapid recovery. Enhanced recovery is based on established day surgery principles with the aim to improve the quality of recovery after inpatient surgery such that the patients can go home earlier and healthier.

The main aims of our anaesthetic technique is smooth onset of action, adequate intraoperative analgesia and amnesia, good surgical condition, rapid recovery and minimal adverse effects. Enhanced recovery is the outcome of applying a range of multimodal strategies that has been designed to prepare and optimise patients before, during and after surgery, ensuring prompt recovery and discharge.<sup>5</sup>

Since the introduction of the first laparoscopic cholecystectomy procedures, laparoscopy has expanded impressively both in scope and volume. It quickly became apparent that laparoscopy results in multiple benefits compared with open procedures and was characterized by better maintenance of homeostasis. Laparoscopy leads to ventilatory changes as the pneumoperitoneum created decreases thoracopulmonary compliance by 30% to 50% in healthy and obese patients. Reduction in functional residual capacity and development of atelectasis due to elevation of the diaphragm and changes in the distribution of pulmonary ventilation and perfusion from increased airway pressure can be expected. However, increasing IAP to 14 mm Hg with the patient in a 10- to 20-degree head-up or head-down position does not significantly modify either physiologic dead space or shunt in patients without cardiovascular problems.<sup>6,7</sup>

Many studies have been conducted to evaluate the post-op recovery characteristics and readiness for discharge like Aldrete scoring, Mini mental state examination and post anaesthesia discharge scoring and many more. But there are not much studies comparing these recovery characteristics using isoflurane, sevoflurane and desflurane. The primary outcome of the study was to evaluate the time to extubation after termination of the various inhalational agents. The secondary outcome was to evaluate other recovery characteristics for discharge criteria.

#### MATERIALS AND METHODS:

A randomized study was carried out on 120 patients of either sex, ASA grade I and II, in age group of 20-70 years undergoing laparoscopic. After approval from hospital ethics committee, a prior informed written consent was taken from all the patients.

The exclusion criteria included those with clinically significant cardiovascular, respiratory, hepatic, renal, neurologic, psychiatric or metabolic disease; pregnant women; morbid obesity; those with a history of alcohol and drug abuse; patients not willing to give consent.

Patients were allocated into 3 groups of 40 each by computer generated number.

Group A – Induction with propofol(2-3mg/kg) and fentanyl(2µg/kg) and maintenance with isoflurane

Group B – Induction with propofol(2-3mg/kg) and fentanyl(2µg/kg) and maintenance with sevoflurane

Group C – Induction with propofol(2-3mg/kg) and fentanyl(2µg/kg) and maintenance with desflurane

All patients included in the study were subjected to a detailed pre-anaesthetic check-up and airway assessment one day prior to surgery. Details pertaining to patient's clinical history, general physical and systemic examination and basic routine investigations were noted. All patients were appraised about different scores in their own vernacular language. Baseline modified minimal state examination (MMSE) score were recorded.

On arrival in the operating room, standard monitoring was attached and intravenous line was started with Ringer's lactate.

Intraoperative monitoring includes pulse rate(PR), electrocardiogram (ECG), blood pressure (BP), oxygensaturation (SPO<sub>2</sub>).

Premedication was given with injection glycopyrrolate(0.004mg/kg), midazolam(0.02mg/kg) and fentanyl(2µg/kg) 10 minutes prior to induction. After pre-oxygenation with 100% oxygen for 3 minutes, general anesthesia was induced with injection propofol 2-3 mg/kg in all the groups. Injection vecuronium(0.08mg/kg) was used to facilitate orotracheal intubation with a cuffed endotracheal tube of appropriate size. Anaesthesia was maintained with either isoflurane(group A) or sevoflurane(group B) or desflurane(group C) in combination with N<sub>2</sub>O and O<sub>2</sub>. According to the MAC using RGM, concentration of maintenance anaesthetic was varied such that MAC remains approximately 1 and blood pressure remains ±20% of the baseline values. All patients were mechanically ventilated to maintain end tidal CO<sub>2</sub> within 27-32 mm of mercury.

In all cases, ondansetron(4mg)iv was administered intraoperatively for prevention of PONV and injection paracetamol(1g)iv was given to prevent postoperative pain. The volatile anaesthetic and nitrous oxide was switched off after the last suture. This was

considered  $T_b$  (baseline time). Reversal with neostigmine 0.05 mg/kg and glycopyrrolate 0.01 mg/kg was given. An independent observer blinded to agents used was called at this point of time, who later recorded the recovery characteristics till street fitness. Extubation was done when adequate and regular spontaneous breathing was established and patients were able to open eyes to commands.

The time to achieve extubation was measured from time of termination of anesthetic gas ( $T_b$ ). The Aldrete score was checked at 5 minutes after extubation. This score was considered as baseline. The time to achieve Aldrete score  $\geq 8$  was recorded and patients shifted to recovery room.

For second stage of recovery, Aldrete score was noted on arrival to recovery room and then half hourly for 2 hours. Modified minimal state examination was done immediately and later at 120 minutes. Patients were kept in recovery room till achiev-

## OBSERVATIONS

All the three groups were comparable demographically.

TABLE:

Primary outcome	Group 1 (mins) Mean $\pm$ SD	Group 2 (mins) Mean $\pm$ SD	Group 3 (mins) Mean $\pm$ SD	Group 1 vs 2 p value	Group 1 vs 3 p value	Group 2 vs 3 p value	Statistical analysis Group 1 vs 2	Statistical analysis Group 1 vs 3	Statistical analysis Group 2 vs 3
Time to extubation	11.63 $\pm$ 4.348	9.55 $\pm$ 6.528	8.23 $\pm$ 1.888	0.119	0.004*	0.414	NS	S	NS

Secondary outcome	Group 1 (mins) Mean $\pm$ SD	Group 2 (mins) Mean $\pm$ SD	Group 3 (mins) Mean $\pm$ SD	Group 1 vs 2 p value	Group 1 vs 3 p value	Group 2 vs 3 p value	Statistical analysis Group 1 vs 2	Statistical analysis Group 1 vs 3	Statistical analysis Group 2 vs 3
Time of aldrete 8	17.48 $\pm$ 5.561	15.03 $\pm$ 8.423	13.08 $\pm$ 3.253	0.178	0.005*	0.332	NS	S	NS
Time of aldrete 12	76.50 $\pm$ 13.019	66.65 $\pm$ 16.454	60.75 $\pm$ 13.204	0.007*	0.000**	0.16	S	HS	NS
Time to achieve Street fitness	10.00 hrs $\pm$ 0.000	10.00 hrs $\pm$ 0.000	10.00 hrs $\pm$ 0.000	-	-	-	NS	NS	NS

The time to extubation was significantly lower in desflurane group (8.23 $\pm$ 1.888) as compared to isoflurane group (11.63 $\pm$ 4.348). The time to achieve aldrete score of 8 was lower in case of desflurane (13.08 $\pm$ 3.253) as compared to sevoflurane (15.03 $\pm$ 8.423) and isoflurane (17.48 $\pm$ 5.561). Also the time to achieve aldrete score of 12 was lower in case of desflurane (60.75 $\pm$ 13.204) as compared to sevoflurane (66.65 $\pm$ 16.454) and isoflurane (76.50 $\pm$ 13.019). The time to achieve street fitness was same among all the groups, so it was not significant.

## DISCUSSION

For day care anaesthesia, the use of anaesthetics that provide fast and smooth induction, allow fast changes in intensity while maintaining anaesthesia, early recovery and have no or minimal postoperative side effects are suggested. Considering these characteristics, fast induction and early recovery based on low blood/gas partition coefficients is expected from newer inhalational agents sevoflurane and desflurane compared with traditional agents like isoflurane, halothane and propofol. We conducted this study because there are not much studies comparing the recovery characteristics with desflurane, sevoflurane and isoflurane.

Time to extubate was decided on the basis of spontaneous breathing and eye opening and was 11.63 $\pm$ 4.348mins for isoflurane, 9.55 $\pm$ 6.528mins for sevoflurane and 8.23 $\pm$ 1.888mins for desflurane. Dupont et al noted extubation time to be 8.9mins with desflurane, 18mins with sevoflurane and 16.2mins with isoflurane. However in this study although it was found that desflurane group had early extubation than sevoflurane and isoflurane, but the duration varied may be due to difference in drug use and type of surgery. This mattered especially in laparoscopic cholecystectomy. The time to achieve aldrete score of

ing Aldrete score of  $\geq 12$  and modified MMSE is  $\geq 9$ . Time to achieve Aldrete score of 12 from  $T_b$  was recorded.

In the ward (third stage of recovery) patient was checked every 2 hours for street fitness. Street fitness of the patient was checked to ascertain if he was able to walk, dress, able to drink and pass urine. The time to achieve street fitness was noted. Also the intensity of pain, nausea and vomiting was noted according to visual analog scale (VAS). Postoperative analgesia was given to patients in the form of oral/i.m diclofenac 75mg when VAS score  $\geq 40$ . Any untoward effects were noted and treated.

The data recorded was compiled and statistically evaluated. The power of 0.99 and  $\alpha$  error of 0.05 with primary analysis of power being done for time to extubation and aldrete score, was calculated. Statistical analysis was done with one way ANOVA with Post-Hoc Tukey HSD for parametric data and Chi-square test for non-parametric data.

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## COMPLICATIONS

Pain was observed in 4 patients in group 1, 3 patients in group 2 and in 3 patients in group 3. The treatment given was Inj. Diclofenac 75mg i/m. It was found to be statistically non significant. Nausea and vomiting was present in 3 patients in group 1, 1 patient in group 2 and in 4 patients in group 3. The treatment given was ondansetron (4mg) iv. It was found to be statistically non significant. Other complications such as bradycardia, hypotension, urinary retention, respiratory depression, convulsions or anaphylactic reactions were not seen in any of the patients.

Gergin et al<sup>8</sup> conducted a study comparing recovery characteristics of sevoflurane and desflurane and concluded that most frequent side effect after surgery was nausea and vomiting. Although the incidence of these symptoms was greatest in the desflurane group, the difference was not statistically significant ( $p > 0.05$ ).

Erk et al<sup>9</sup> conducted a study on the comparative evaluation of desflurane, sevoflurane and propofol in laparoscopic cholecystectomy and concluded that the use of combined prophylactic antiemetic treatment may be considered as effective reason of low observance rate of PONV.

Wang et al<sup>10</sup> conducted a study on prophylactic antiemetic effect of dexamethasone in women undergoing ambulatory laparo-

scopic surgery and concluded that PONV was markedly reduced in laparoscopic surgery by the use of prophylactic antiemetic treatment. Our results also indicate low incidence of PONV may be due to the use of propofol and ondansetron.

#### SUMMARY AND CONCLUSION

Finally to conclude the initial recovery may be more rapid with desflurane and sevoflurane as compared with isoflurane, but the time to be fit for discharge did not differ among the three groups as the street fitness was similar in all the groups. However keeping in view the uncertainty/unpredictability of completion of surgery during laparoscopic cholecystectomy this rapid return of reflexes and respiration is desirable.

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