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Comparison of Desflurane Versus Sevoflurane on Awakening and Quality of Recovery in Patients Undergoing Elective Laparoscopic Cholecystectomy

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Abstract
To compare Desflurane versus Sevoflurane on awakening and quality of recovery in patients undergoing elective laparoscopic cholecystectomy. We selected eighty patients, undergoing elective laparoscopic cholecystectomy which were divided into 2 groups, 40 in each group (Group S: sevoflurane, Group D: Desflurane). The time to eye opening, time to obey verbal command, the time to shifting to recovery, Aldrete score, PADSS scores and quality of recovery questionnaire 40 were compared in both groups. Results were statistically analyzed. The time to eye opening was 3.14±1.09 minutes in group D and 6.07 ± 1.91 minutes in group S. The time to obey verbal command was 3.63 ± 1.16 minutes in group D and 6.62±1.99 minutes in group S. The time to shifting to recovery was 5.08±1.18 minutes in group D and 7.87±2.2 minutes in group S. The mean orientation was 4.47±1.09 minutes in group D and 7.05±2.23 minutes in group S. The difference was significant (P<0.05). Statistically significant difference was seen in the Aldrete score at 5 minutes between group D and group S. (P<.05). The majority (57.50%) of patients in group D whereas in group S only 25% of patients reached score 9. No significant difference was seen in PADSS scores at 15 minutes, 30 minutes and 45 minutes P>.05) At 15 minutes, 30 minutes and 45 minutes, PADSS score distribution was comparable in both the groups with majority of patient's PADSS score as 9 (P>.05). The mean value of quality of recovery questionnaire 40 (QoR-40) in group D was 180.78 ± 17.63 and in group S was 185.1±16.45. No significant difference was seen in QoR-40 between the two groups (P>.05). Time for early recovery like eye opening, follow verbal command, sit with support shift to recovery, orientation to time, place and person is faster with desflurane. Both inhalational anaesthetic agents are good for maintenance of surgery but early recovery is better with desflurane compare to sevoflurane.

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INTRODUCTION

An ideal general anesthetic, should provide smooth and rapid induction, optimal operating conditions rapid recovery with minimal side effects[1]. In order to emerge from anesthesia, a patient must be able to follow instructions, breathe on their own, regain awareness reverse any neuromuscular blockade that may have been applied. An inhaled anesthetic gas, intravenous propofol, or a mix of the two can be administered to patients in need of general anesthesia[1]. Because volatile anesthetic gases are less soluble in blood than other anesthetic gases, they enable quick anesthesia recovery. Inhalation agents do cause respiratory depression, even though volatiles are generally safe for patients, this might still be an issue if the patient is moved to the post-anesthesia care unit (PACU). Longer PACU or hospital stays, atelectasis, hypoxia hypercarbia can all result from respiratory depression. Additionally, the absence of protective airway reflexes brought on by general anesthesia may result in pulmonary aspiration[2].

Desflurane is a halogenated ether. Low solubility of desflurane in blood and body tissues (blood: gas partition coefficient of 0.42 and fat: blood solubility 27 at 37°C) which leads to rapid induction and recovery[3]. Sevoflurane, another halogenated ether, is a volatile anaesthetic agent. It also has rapid induction due to low blood: gas partition (blood: gas partition coefficient of 0.65 and fat: blood solubility 48 at 37°C). Thus, a randomized control study was set to assess the emergence characteristics of the two drugs for elective cholecystectomy surgeries[4]. The primary objective was to compare early awakening and quality of recovery (LIKERT scale) in desflurane and sevoflurane using time to eye opening and time for responding verbal command. The primary objective was to compare intermediate awakening and home readiness in patient receiving desflurane and sevoflurane using ALDRETE Score and PADSS score respectively.

MATERIALS AND METHODS

After considering the utility of the study and obtaining approval from the ethical review committee, we selected eighty patients, undergoing elective laparoscopic cholecystectomy. Patients' consent was obtained before starting the study. Inclusion criteria was patients of either sex undergoing elective cholecystectomy, age: 18-64 years, ASA physical status: I and II. Exclusion criteria was BMI >30 kg/m^2, anticipated difficult intubation, surgery >2 hours, significant systemic diseases, history of drug allergy or drug abuse pregnant/ breast feeding female patients. Data such as name, age, etc. was recorded. Taking values given by Dalal K S *et al*[5] as reference, the minimum required sample size with 95% power of study and 5% level of significance was 24 patients in each study group. To reduce margin of error, total sample size taken was 80 and were divided into 2 groups, 40 in each group (Group S: sevoflurane, Group D: Desflurane). Method of randomisation was block randomization with seal envelope.

In the operating room, an intravenous (IV) line was secured on the non-dominant hand of the patient. Monitors were attached and baseline heart rate (HR), mean arterial pressure (MAP), ECG oxygen saturation (SpO2) were recorded. All patients received fentanyl citrate 2 mcg/kg iV and were preoxygenated prior to the induction of anaesthesia. Anaesthesia was induced with propofol 2 mg/kg IV. After loss of consciousness, ventilation of lungs was manually assisted. Neuromuscular blockade was achieved with vecuronium bromide 0.1 mg/kg IV and airway secured with a supraglottic device (Proseal LMA) of appropriate size. Group S received sevoflurane 1-2% group D received desflurane 3-4% with 60% nitrous oxide in oxygen. Ondansetron 0.1mg/kg i.v and paracetamol 1mg/kg iv were given 30 minutes prior to the end of surgery. The ports were infiltrated with local anaesthetic with 0.25% bupivacaine up to 20 ml. The neurovascular blockage was reversed with inj. Glycopyrrolate 0.01mg/kg and inj. Neostigmine 0.05mg/kg intravenously. The time of awakening was noted from discontinuation of volatile anaesthetic to the spontaneous eye opening. Time taken to respond to verbal command was also noted from discontinuation of volatile anaesthetic agent. Aldrete scoring system (activity, respiration, circulation, consciousness and oxygen saturation) PADS score for home readiness at 5 and 15 minutes respectively, when score 9 or more achieved, patients were shifted from post anaesthetic care unit. The QoR-40 questionnaire consists of 40 questions that examine 5 domain of patient recovery on a 5 points Likert scale, none of the time and all of the time which was given to all the patients at 24 hours. The 5 domains include physical comfort, pain, psychological support, emotional state and physical independence. The results were compiled and subjected to statistical analysis. Quantitative variables were compared with unpaired t test. Qualitative variables were compared with Chi-Square test. $P<0.05$ was regarded as significant.

RESULTS AND DISCUSSIONS

The mean age was 34.15±11.01 years in group D and 32.78±11.04 years in group S. There were 36 females and 4 males in group D and group S. The mean BMI was 23.59±3.67 kg/m^2 and 22.53±3.23 kg/m^2. ASA Grade (I/II) was 37/3 and 39/1 and the mean duration of surgery was 63.92±13.21 minutes in group D and 70.65±14.15 minutes in group S. The difference was non- significant ($P>0.05$) (Table I).

The time to eye opening was 3.14±1.09 minutes in group D and 6.07±1.91 minutes in group S. The time to obey verbal command was 3.63±1.16 minutes in group

D and 6.62±1.99 minutes in group S. The time to shifting to recovery was 5.08±1.18 minutes in group D and 7.87±2.2 minutes in group S. The mean orientation was 4.47±1.09 minutes in group D and 7.05±2.23 minutes in group S. The difference was significant (P< 0.05) (Table 2).

Statistically significant difference was seen in the Aldrete score at 5 minutes between group D and group S. (P<.05). The majority (57.50%) of patients in group D whereas in group S only 25% of patients reached score 9 (Table 3).

No significant difference was seen in PADSS scores at 15 minutes, 30 minutes and 45 minutes P>.05) At 15 minutes, 30 minutes and 45 minutes, PADSS score distribution was comparable in both the groups with majority of patient's PADSS score as 9 (P>.05) (Fig I).

QoR 40 sub score was comparable between two groups for all domains (Fig 2).

The mean value of quality of recovery questionnaire 40(QoR-40) in group D was 180.78±17.63 and in group S was 185.1±16.45. No significant difference was seen in QoR-40 between the two groups (P>.05) (Fig 3).

During surgical procedures, inhalation gases are used in conjunction with other medications to guarantee analgesia, forgetfulness, anesthesia muscle relaxation (or paralysis). For the greatest possible result, inhalation gasses are frequently employed to induce unconsciousness without causing discomfort and to ensure a speedy recovery[6]. The precise mechanism of action of inhalation agents on the human brain remains largely unknown, despite the fact that their use dates back to the 1840s. Three volatile agents (isoflurane, sevoflurane desflurane) and one non-volatile agent (nitrous oxide) make up modern anesthetic gasses[7]. Together with oxygen or room air, these gases are used to put patients into a sleep-like state while giving them enough oxygen to prevent tissue damage. The anesthetic potency, arrhythmogenic properties, flammability chemical stability of the three volatile agents are affected by their halogenation, which is the substitution of a halogen atom for one or more hydrogen atoms. In order to prevent overdosing the patient, the volatile substances must also be evaporated, turning from a liquid to a gas[8]. This study assessed the emergence characteristics of the two drugs for elective cholecystectomy surgeries.

In this study, early recovery parameters between the groups including time to eye opening, time to obey verbal commands, time to sit with support, time to shifting to recovery room, orientation were found to be significantly better in group D than group S. De Oliveira G S *et al*[9] conducted a study comparing desflurane /fentanyl with sevoflurane /fentanyl on awakening and quality of recovery and concluded desflurane retains faster awakening properties than does sevoflurane similar to our study. Gupta P *et al*[10] conducted similar study in Pediatric age group and concluded extubation time to be shorter in desflurane group. Fanelli *et al*[11] conducted a similar study to evaluate the effects of sevoflurane and desflurane in combination with intravenous remifentanil to conclude emergence, response and extubation occurred earlier after desflurane.

Chen *et al*[12] compared the adverse respiratory events and recovery results of patients receiving ambulatory surgery under desflurane vs sevoflurane-based anesthesia. There were 634 patients in the group treated with desflurane and 633 patients treated with sevoflurane. When desflurane-based anesthesia was used instead of sevoflurane-based anesthesia, respiratory problems were much more common with minimal heterogeneity (I2=20%). Between the desflurane and sevoflurane groups, there was no difference in the incidence of PONV or the emergence

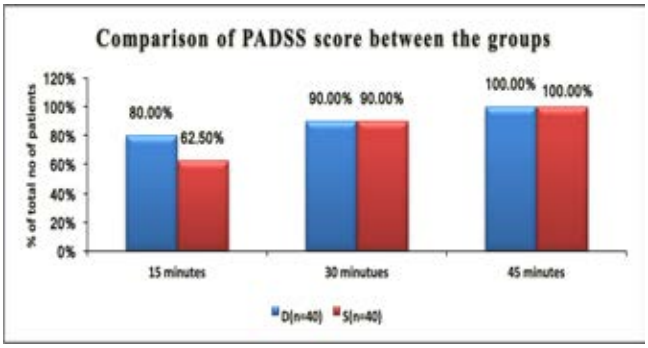

Fig 1: Comparison of PADSS score between the groups

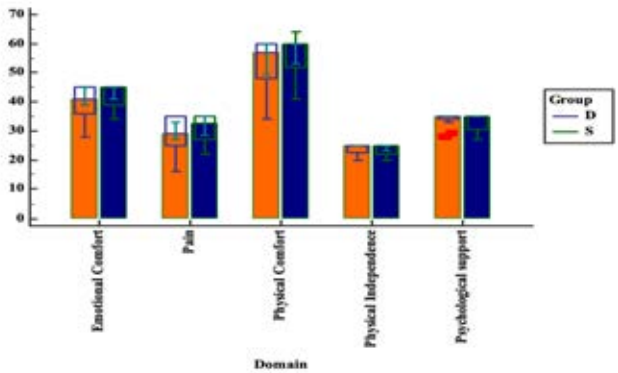

Fig 2: Assessment of late recovery

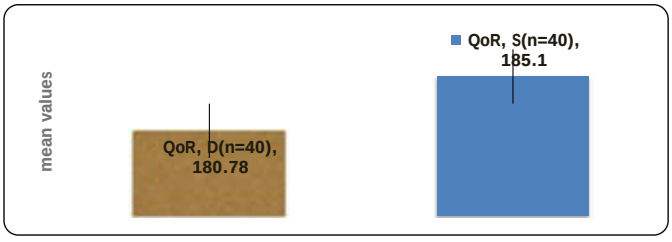

Fig 3: Comparison of QoR-40 between the groups

Table 1: Comparison of demographic characteristics.

Parameters	Group D (n=40)	Group S (n=40)	p-value
Age in years	34.15±11.01	32.78±11.04	0.54
Gender (Female/Male)	36/4	36/4	1
BMI (kg/m^2)	23.59±3.67	22.53±3.23	0.134
ASA grade (I/II)	37/3	39/1	0.615
Duration of surgery (minutes)	63.92±13.21	70.65±14.15	0.031

Table 2: Assessment of early recovery parameters

Early recovery parameters	Group D	Group S	p-value
Time to eye opening (minutes)	3.14±1.09	6.07±1.91	0.01
Time to obey verbal command (minutes)	3.63±1.16	6.62±1.99	0.01
Time to shifting to recovery (minutes)	5.08±1.18	7.87±2.2	0.01
Orientation	4.47±1.09	7.05±2.23	0.01

Table 3: Assessment of intermediate recovery

Aldrete score of 9	Group D	Group S	p-value
5 minutes	23 (57.50%)	10 (25.00%)	0.013
10 minutes	29 (72.50%)	20 (50.00%)	0.118
15 minutes	38 (95.00%)	28 (70.00%)	0.006
20 minutes	40 (100.00%)	36 (90.00%)	0.116
25 minutes	40 (100.00%)	38 (95.00%)	0.494

agitation. With a large heterogeneity (I2=72.6%), the time to eye opening was considerably faster with desflurane than with sevoflurane. The two groups' times to leave the operating room were not significantly different.

CONCLUSION

Time for early recovery like eye opening, follow verbal command, sit with support shift to recovery, orientation to time, place and person is faster with desflurane. Both inhalational anaesthetic agents are good for maintenance of surgery but early recovery is better with desflurane compare to sevoflurane.

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