

Efficiency of Isoflurane and Sevoflurane on Length of Hospitalization and Emergence Time

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Received: 22-03-2023 / Revised: 11-04-2023 / Accepted: 17-05-2023

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Conflict of interest: Nil

Abstract

Introduction: The following report has described the time of hospitalization as not distinct between isoflurane and sevoflurane. However, further plausible outcomes of employing soluble volatile anaesthetics that have been deferred emergence from anaesthesia and prolonged stays in the "postanaesthesia care unit (PACU)". Furthermore, this research paper has likened isoflurane and sevoflurane to emergence moment and PACU time.

Aims and objectives: The study aims to determine the efficiency of isoflurane and sevoflurane on length of hospitalization and emergence time.

Methods: This prospective study analyzed data from 80 patients, who underwent non-cardiac surgery at a hospital from April 2022 to March 2023. Demographic and morphometric data were collected from computerized anesthesia records. Patients who were admitted to the intensive care unit, had MAC percentage greater than 0.3, or skipped the PACU were excluded. Descriptive statistics and standard differences were used to compare the isoflurane and sevoflurane groups. Inclusion criteria were limited to patients receiving either isoflurane or sevoflurane anesthesia, with exclusion criteria for certain medical conditions or multiple anesthetics.

Results: The study found that there is a significant difference between the two groups in terms of ASA physical status ($p=0.004$). The presence of metastatic cancer is significantly different between the isoflurane and sevoflurane groups ($p=0.041$). Other factors such as body mass index (BMI), patient age, duration of surgery, gender, and various medical conditions do not show significant differences between the two groups ($p>0.05$).

Conclusion: The study has concluded that isoflurane can be used in most cases in PACU as it has many beneficial characteristics like longer emergence time of the patients.

Keywords: Isoflurane, Sevoflurane, Anaesthesia, Emergence Time.

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Introduction

Although difficult, it is desirable to keep "post anaesthesia care unit (PACU)" stay and emergence time to a minimum.

Anesthesia method and surgical time have emergence time and PACU duration of stay have been recognized as common factors,

along with the type of volatile anaesthetic being perhaps significant [1]. For instance, typically soluble volatile anaesthetics that have a longer duration of action encourage residual sedation and longer PACU lengths of stay. On the other hand, Early emergence and shorter PACU stays are encouraged by less soluble and therefore faster acting anaesthetics [2,3].

Quicker emergence is defined by a variety of endpoints, such as the amount of time it takes between the end of anaesthesia and the moment the eyes open, the time it takes to respond to spoken orders or the time it takes to become oriented. Additionally, shorter-acting sevoflurane costs more by twelve per “minimum alveolar concentration (MAC)” hour than isoflurane at the same fresh gas flow [3,4]. The most often used volatile anaesthetics in the US are isoflurane and sevoflurane, However, it is still uncertain whether the additional cost of the anaesthetic may be balanced out by future cost savings through a quicker recovery [5].

MAC measures the number of volatile anaesthetics present, and that in turn represents the concentration in the brain. Around 0.3 MAC (MAC awake), volatile anaesthetics typically come to an end. Sevoflurane, for instance, has a low blood solubility when compared to isoflurane and quickly reaches equilibrium within the brain, causing onset and offset to occur more quickly. Sevoflurane should therefore induce recovery from anaesthesia more quickly than isoflurane [5].

Cost increases have been connected to lengthier PACU stays and prolonged emergence times. Cost reductions won't materialize, though, until more operations are conducted in the spare surgical suite time or fewer PACU nurses are employed [6,7]. However, patients, their loved ones, nursing staff, and other staff see extra surgery time as well as delays in PACU departure as challenging, and they have an effect on surgical workflow. Family and

patient satisfaction is also negatively impacted. Even while isoflurane is less expensive, its use may result in higher overall costs if it significantly prolongs PACU stays and emergence times [7,8].

Without the use of intravenous medications, fast induction of anaesthesia is achieved via single-breath inhaling of a volatile anaesthetic. Additionally, single-breath induction can help patients wake up more quickly by removing the "hangover" related to intravenous induction drugs (1). It is especially beneficial for people who are afraid of getting shots or in situations where getting an IV is challenging. Although cyclopropane (2), halothane (3), and isoflurane (4) can all be used to induce a single breath, their usage has been constrained due to the drawbacks of each anaesthetic [9-11]. Sevoflurane's blood-gas solubility coefficient is minimal, with no odour, and is not irritating to the airways. All of these characteristics imply that this device would be especially helpful for quick inhalational anaesthesia induction [12].

The innovative volatile inhaled anaesthetic sevoflurane (fluoromethyl 2,2,2-trifluoro-1-[trifluoro methyl] ether) has a blood-gas partition value of 0.6., which is lower than that of other inhaled anaesthetics already in use [13]. Sevoflurane has been shown to have a smooth anaesthetic induction, a quick recovery from anaesthesia, & no organ toxicity in prior animal as well as early human research. Sevoflurane should be able to induce anaesthesia more quickly than commonly used inhaled anaesthetics since it is poorly soluble in blood gases, however, this has yet to be thoroughly tested [14,15].

Methods

Study design

This prospective study was conducted on 80 patients from April, 2022 to March, 2023, who underwent non-cardiac surgery in our hospital. A secondary analysis of an already conducted analysis was done on 80

patients. From the computerized anaesthesia records, we gathered data regarding the primary results, emerging duration, and PACU stays. The demographic and morphometric parameters were retrieved in a similar manner.

Patients who underwent straight admission to an intensive care unit didn't have a MAC percentage that was greater than 0.3, or entirely skipped the PACU were all omitted. Using conventional descriptive statistics and absolute standardised differences, we examined the isoflurane as well as sevoflurane groups' morphological and demographic traits in a descriptive manner. We mostly contrasted isoflurane with sevoflurane in terms of emergence time and time spent in the PACU.

Inclusion and exclusion criteria

The study included individuals who underwent noncardiac surgery while under sevoflurane or isoflurane-based volatile anaesthesia. The study was limited to a small number of anaesthesiologists who oversee a solitary collection of operating rooms frequently used for parathyroid, thyroid, and colorectal surgery. Patients who received more than one volatile anaesthetic, underwent urgent surgery, or were already being treated in a hospital due to a medical problem were eliminated.

Statistical analysis

The study has used SPSS 25 for effective statistical analysis. The continuous data has been written in mean \pm standard deviation while the discrete data has been presented as frequency and its respective percentage. The study as employed ANOVA as the statistical tool for its analysis. The level of significance was considered to be $P < 0.05$.

Ethical approval

Each patient was explained about the process of the study and the consent was obtained from each of them. The study

process has been approved by the Ethical Committee of the concerned hospital.

Results

Table 1 shows the demographics of the patients. The patients were divided into two groups receiving isoflurane and sevoflurane with 40 patients in each group. The mean age of the patients is 48 years, mean BMI is 27. The mean duration of surgery is 2.3 hours. 42.5% of the patients are males. ASA 1 status is high in the sevoflurane group (52.5%) compared to isoflurane (2.5%). pulmonary circulation, diabetes, cardiac diseases, and liver diseases are also assessed in the patients. Table 1 presents baseline and demographic characteristics of patients who underwent anesthesia with either isoflurane or sevoflurane. The table includes various factors such as body mass index (BMI), patient age, duration of surgery, gender (male or female), ASA physical status (a measure of overall health status), presence of various medical conditions, and other parameters related to anesthesia and pain management. The study found that the factor "ASA physical status" has a p-value of 0.004, which is less than 0.05, suggesting that there is a significant difference between the two groups in terms of ASA physical status. This indicates that the ASA physical status of the patients in the isoflurane group is significantly different from that of the patients in the sevoflurane group. Additionally, the factor "Metastatic cancer" has a p-value of 0.041, which is also less than 0.05, indicating a significant difference between the two groups in terms of metastatic cancer. This suggests that the presence of metastatic cancer is significantly different between the isoflurane and sevoflurane groups. Other factors such as body mass index (BMI), patient age, duration of surgery, gender, and various medical conditions do not show significant differences between the two groups ($p > 0.05$).

Table 1: Baseline and demographic characteristics of patients in this study

| Factor | Isoflurane (N = 40) | Sevoflurane (N = 40) | p-value |
|---|------------------------|-------------------------|---------|
| Body mass index (kg/m ²) | 26 ± 7 | 26 ± 5 | 0.72 |
| Patient age, y | 48 ± 14 | 48 ± 14 | 0.84 |
| Duration of surgery, h | 1.3 (0.5, 2.6) | 1.3 (0.4, 2.4) | 0.6 |
| Male, N (%) | 17 (42.5) | 17 (42.5) | 0.81 |
| ASA physical status | | | 0.004 |
| I | 1 (2.5) | 21 (52.5) | |
| II | 17 (42.5) | 19 (47.5) | |
| III | 20 (50) | 16 (40) | |
| IV | 2 (5) | 1 (2.5) | |
| Emergency, N (%) | 2 (5) | 2 (5) | 0.51 |
| Pulmonary circulation disease | 3 (7.5) | 3 (7.5) | 0.32 |
| Peripheral vascular disease | 1 (2.5) | 1 (2.5) | 0.53 |
| Congestive heart failure | 3 (7.5) | 2 (5) | 0.94 |
| Valvular disease | 1 (2.5) | 3 (7.5) | 0.65 |
| Hypertension | 11 (27.5) | 13 (32.5) | 0.53 |
| Chronic pulmonary disease | 4 (10.0) | 5 (12.5) | 0.82 |
| Diabetes without chronic complications | 3 (7.5) | 4 (10) | 0.77 |
| Hypothyroidism | 5 (12.5) | 3 (7.5) | 0.21 |
| Renal failure | 18 (2.9) | 31 (3.5) | 0.39 |
| Liver disease | 15 (2.4) | 13 (1.6) | 0.34 |
| Lymphoma | 1 (2.5) | 1 (2.5) | 0.36 |
| Metastatic cancer | 4 (10.0) | 3 (7.5) | 0.041 |
| Solid tumor without metastasis | 6 (15) | 6 (15) | 0.87 |
| Deficiency anemias | 3 (7.5) | 3 (7.5) | 0.19 |
| Drug abuse | 1 (2.5) | 1 (2.5) | 0.76 |
| Psychoses | 2 (5) | 2 (5) | 0.38 |
| Depression | 4 (10.0) | 4 (10.0) | 0.79 |
| Rheumatoid arthritis/collagen vascular disease | 2 (5) | 1 (2.5) | 0.94 |
| Coagulopathy | 2 (5) | 1 (2.5) | 0.07 |
| Obesity | 5 (12.5) | 6 (15) | 0.93 |
| Fluid, electrolyte disorders | 7 (17.5) | 6 (15) | 0.17 |
| Abdominal surgery | 29 (72.5) | 28 (70) | 0.79 |
| Time-weighted average end-tidal volatile anesthetic (%) | 0.8 (0.2, 2.1) | 1.3 (1.4, 3.3) | <.001 |
| Total intraoperative opioid use (mg)d | 13 (9, 18) | 13 (10, 17) | 0.13 |
| Time-weighted BIS | 22 (20, 25) | 22 (19, 25) | 0.86 |
| Pain scores | 3.5 ± 1.8 | 3.4 ± 1.7 | 0.67 |

We divided the surgical types into abdominal and non-abdominal surgery to determine if the relationship between anaesthesia and results-emergence as well as PACU duration of stay were consistent. 25 patients who got isoflurane underwent abdominal surgery, compared to 18 individuals who received sevoflurane. For

PACU length of stay, abdominal surgery versus non-abdominal surgery and treatment had a significant ($P=0.011$) relationship. In particular, patients given isoflurane were released from the hospital substantially having a hazard ratio sooner compared to those given sevoflurane, but the anaesthetics had no effect on the time it took for patients to recover after abdominal surgery (table 2).

Table 2: Outcome assessment of the patients in each group

| Factor | Isoflurane | Sevoflurane | Hazard ratio * (97.5% CI) | p-value |
|-------------------------|--------------------------|-------------------------|---------------------------|---------|
| Primary analysis | | | | |
| PACU length of stay (h) | 1.8 (1.1-2.8) | 1.7 (1.1-2.9) | 2.2 (1.05-2.19) | 0.57 |
| Emergency (minutes) | 17 (13-24) | 15 (13-20) | 0.86 (0.74-0.95) | 0.001 |
| Secondary analysis | | | | |
| PACU stay (h) | | | | |
| Non-abdominal surgery | (n=15) 2.3 (1.8-2.9) | (n=18) 2.4 (1.8-3.3) | 1.41 (1.08-1.76) | 0.007 |
| Abdominal surgery | (n=25) 3.1 (2.4 -3.9) | (n=22) 3.1 (2.2-4.2) | 0.98 (0.83-1.12) | 0.49 |

Discussion

A study previously stated that there were no differences in the length of hospitalization among isoflurane and sevoflurane. But more time in a “post-anaesthesia care unit (PACU)” and a delayed return to consciousness are more likely effects of employing soluble volatile anaesthetics. Therefore, we compared the onset time and PACU duration of isoflurane and sevoflurane. Isoflurane did not increase the time of time in the PACU and only delayed emergence by two minutes, so this is not a significant clinical difference. The greater of water & substantially less expensive anaesthetic sevoflurane seems to be a suitable replacement [16,17].

A study compared the duration of “post-anaesthetic care unit (PACU)” stays and post-general anaesthesia recovery profiles of older patients using sevoflurane and desflurane. In a double-blind fashion, patients were randomly divided into 2 groups: the drug group and the desflurane

group. Using the exact same induction, it is muscle relaxants, and narcotic medicine, all of the patients received general anaesthesia with oral endotracheal intubations. Once the procedure was complete, the volatile chemical was stopped, and muscular relaxation was undone. In senior individuals who underwent general anaesthesia, desflurane was more closely connected with a quicker recovery period (time to open the eyes and obey commands) than sevoflurane. However, both groups' PACU stays were comparable in length [18].

Sevoflurane and isoflurane both have blood: gas partition coefficients that are lower than isoflurane, which may speed up emergence times and recovery from anaesthesia. We looked at a database with recovery outcomes from controlled, randomly allocated, prospective studies funded through Abbott Laboratories which evaluated sevoflurane should isoflurane and propofol when the evacuation was intended to happen right away following

the conclusion of surgical procedure in adult patients. In eight investigations and three studies, sevoflurane and propofol were compared. Calculating the pooling mean variation in recover endpoints between primary anaesthetics required the application of analysis of variance utilizing mean values from the least squares approach. The age of the patient and the length of the case were also factors considered. In all age categories, sevoflurane recovery was 3-4 min quicker than isoflurane recovery, and the distinction was more noticeable for longer-duration surgeries [19].

Sevoflurane should be associated with a quicker recovery from anaesthesia since it possesses lower blood: gas partitioning coefficient than isoflurane. The recovery characteristics of adult patients after anaesthesia were compared in a review and meta-analysis comparing sevoflurane, isoflurane, and propofol. According to observed differences between sevoflurane, isoflurane, and propofol anaesthesia, any isoflurane or propofol, sevoflurane has related to a quicker recovery after anaesthesia than either of these drugs [20].

Sevoflurane should be associated with a quicker recovery from anaesthesia since it possesses lower blood: gas partitioning coefficient than isoflurane. The recovery characteristics of adult patients after anaesthesia were compared between sevoflurane, isoflurane, & propofol in a review and meta-analysis. Sevoflurane has been linked with faster recovery following anaesthesia either due to the observed differences among sevoflurane, isoflurane, or propofol anaesthesia, isoflurane or propofol [21].

Due to compromised cardiopulmonary physiology, severe upper airway blockage together with increased aspiration risks, and reduced cardiopulmonary physiology. Patients who are obese make safe general anaesthesia difficult. Researchers performed a meta-analysis and systematic

review of recovery results in morbidly obese individuals who received general anaesthesia because there aren't enough data on the surgical effects on recovery from general anaesthesia in these patients. For obese patients, postoperative recovery was noticeably quicker following desflurane compared to the anaesthetics sevoflurane, isoflurane, or propofol. Regarding the frequency of PONV, postoperative pain scores, or PACU discharge time, no clinically significant changes were found [22].

Sevoflurane should be linked to a quicker recovery from anaesthesia since it possesses lower blood: gas partitioning coefficient than isoflurane. The differences that have been noted between sevoflurane, isoflurane, and propofol anaesthesia support the hypothesis that using Sevoflurane has been linked to a quicker return to consciousness following anaesthesia than both isoflurane or propofol [23].

Conclusion

The study has concluded that isoflurane can be used in most cases in PACU as it has many beneficial characteristics like longer emergence time of the patients. This research paper has some limitations. Through this above analysis, it had found that in each 2-week involvement age and neither the anesthesiologist nor the physician was blinded in the study. However, it seems unlikely that the rise time or period of vacation in the PACU would be precious. Modifications in the usage of nitrous oxide and the development of opioid management close the conclusion of operation may also influence the emergence period between groups. Though, the potential alternating involvement strategy safeguards against the prejudice of separate anaesthesia providers and decreases their impact on our answers. Moreover, in this active nature of rise and the numerous matters prompting alveolar attention, such as fresh gas flow, little

ventilation, cardiac production, and others. This study paper has discussed that the preliminary point selected for the arrival duration is vague. Furthermore, the researchers consider that this provides the impartial initial point for a difficult, individually evaluated occurrence progression. In conclusion, our study's evaluated outcomes do not run all aspects of discriminative ability between inhalation representatives. Isoflurane's development time was around 2 minutes longer than sevoflurane for anaesthetics permanent a median of 2.5 hours, which is not clinically important. Even less variance will occur for shorter processes. PACU periods were equal for all volatile anesthetics. Isoflurane, which is less affluent than sevoflurane, appears suitable for the popular of anaesthetics.

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