

Retrospective evaluation of the effects of different anesthesia methods on emergence agitation in patients undergoing vitreoretinal surgery

Evaluación retrospectiva de los efectos de diferentes métodos de anestesia sobre la agitación de emergencia en pacientes sometidos a cirugía vitreorretiniana

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Abstract

Objective: The agitation that can occur in patients undergoing vitreoretinal surgery on awakening from general anesthesia is a serious post-operative problem. In our study, we aimed to compare the effects of different anesthesia methods on emergence agitation in patients undergoing vitreoretinal surgery. **Method:** Patients undergoing vitreoretinal surgery were divided into two groups: Total intravenous anesthesia (Group T) and inhalation anesthesia (Group D) according to the maintenance of anesthesia applied by consulting the records. Patients' heart rate, mean blood pressure, extubation quality scores, and Richmond Agitation and Sedation Scale values were examined. **Results:** For the study, data were available from 100 patients undergoing vitrectomy surgery. It was observed that in the total intravenous anesthesia group the quality of extubation and the patients' additional analgesic requirements were better, and the patients' agitation levels at min 0 were lower. **Conclusion:** In our study, it was observed that the choice of total intravenous anesthesia as an anesthetic method in patients undergoing vitreoretinal surgery reduced agitation upon awakening compared to those receiving inhalational anesthesia.

Keywords: Vitreoretinal surgery. General anesthesia. Emergence agitation.

Resumen

Objetivo: La agitación que puede ocurrir en pacientes sometidos a cirugía vitreorretiniana al despertar de la anestesia general es un problema postoperatorio grave. En nuestro estudio, el objetivo fue comparar los efectos de diferentes métodos de anestesia sobre la agitación de emergencia en pacientes sometidos a cirugía vitreorretiniana. **Método:** Los pacientes sometidos a cirugía vitreorretiniana se dividieron en dos grupos: anestesia intravenosa total (grupo T) y anestesia inhalatoria (grupo D), según el mantenimiento de la anestesia aplicado consultando los registros. Se examinaron la frecuencia cardíaca, la presión arterial promedio, las puntuaciones de calidad de la extubación de la Escala de sedación y agitación de Richmond. **Resultados:** Para el estudio se dispuso de datos de 100 pacientes sometidos a cirugía de vitrectomía. Se observó que en el grupo TIVA (total intravenous anesthesia) la calidad de la extubación y los requerimientos analgésicos adicionales de los pacientes fueron mejores, y los niveles de agitación de los pacientes en el minuto 0 fueron menores. **Conclusión:** En nuestro estudio se observó que la elección de la anestesia intravenosa total como método anestésico en pacientes sometidos a cirugía vitreorretiniana redujo la agitación al despertar en comparación con los que recibieron anestesia inhalatoria.

Palabras clave: Cirugía vitreorretiniana. Anestesia general. Agitación de emergencia.

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Introduction

Vitreoretinal surgery is defined as the removal of deformed vitreous that fills the cavity at the back of the eye and surgically intervening in retinal problems. This surgery is performed in situations that affect the structure of the vitreous and hamper vision such as diabetic retinopathy, retinal detachment, trauma, and uveitis.^{1,2}

Emergence agitation is a complication of anesthesia that occurs in the early wake-up period of general anesthesia and is characterized by mental fog, agitation, aggressive behavior disorders, and disruption in perceiving the environment.³

The objective in vitreoretinal surgery is not to elevate intraocular pressure with a slight induction. The Valsalva effect that is caused by cough, gagging, and yelling along with pain seen in patients following the surgery can lead to sudden elevation in venous pressure, venous ruptures, and severe post-operative subchoroidal hemorrhage.⁴

There are studies in the literature on preventing or reducing emergence agitation especially in nasal surgeries and maxillofacial surgeries.^{5,6} However, the data on vitreoretinal surgeries in this regard are limited. In this study, we aimed to compare the effects of total intravenous anesthesia and inhalation anesthesia with desflurane on post-operative emergence agitation in patients who underwent vitreoretinal surgery.

Method

The study was planned as retrospective research including patients aged between 18 and 70 years who underwent vitreoretinal surgery in the Eye Diseases Clinic between April 30 and 2018 and November 01 2020 and whose American Anesthesiologists Association (ASA) risk scores were I-III. After obtaining ethics committee approval (2021/384), the patient files in the hospital archives were screened.

In the hospital where the study was conducted, following the standard monitorization and premedication of the patients, 1 µg/kg fentanyl, 3 mg/kg propofol and 1 mg/kg rocuronium are applied for anesthesia induction, and anesthesia maintenance is provided with desflurane and 2-3 mcg/kg/dk remifentanil with 50% oxygen mixture, while in some patients, the maintenance is ensured with 6 mg/kg/h propofol and 0.5 mcg/kg/min remifentanil with 50% oxygen mixture.

Following induction, in addition to standard monitorization, the Train-of-Four Ratio monitorization is applied. After the completion of the surgery, 2 mg/kg sugammadex is administered to the patients, and when muscle power is recovered, the patient is extubated. In the recovery unit, as a routine application, 5-point extubation quality scale and Richmond Agitation Sedation Scale (RASS) scores are recorded. In the follow-up, it is checked whether the patients have nausea and vomiting and additional analgesics requirements. In addition, Numerical Rating Scale values of the patients' pain levels are recorded in patient files.

In light of this information, the patients were divided into two groups as total intravenous anesthesia group (Group T) and desflurane anesthesia group (Group D) according to the anesthesia maintenance they received. For the study parameters, anesthesia follow-up forms and hospital computer records were examined. The patients who had drug allergy, a neurological or psychiatric disorder, cirrhosis and chronic renal failure, severe cardiovascular and respiratory disorders, coagulation disorder, and whose surgery lasted more than 3 hours were excluded from the study.

As follow-up parameters, the patients' demographic data (age and gender), body mass indices, ASA risk scores, and surgery and anesthesia durations were noted by examining the records. Besides, intraoperative and recovery unit post-operative records were analyzed, and hemodynamic data, history of nausea/vomiting, additional analgesic requirements, emergence agitation levels, extubation quality scale, and RASS scores were recorded.

The study data obtained were analyzed through "Statistical Package for the Social Sciences" for Windows Release 22.0 software. In the comparison of qualitative data, χ^2 was used, while in the comparison of the data obtained through measurement, compliance with normal distribution was checked by Kolmogorov-Smirnov test, and if the normal distribution assumption is met, Student's t test was used, if not, Mann-Whitney U test was employed. In the comparison of the measurements made from the beginning, repetitive measurement variance analysis or Friedman test was used. The data obtained through measurement were expressed as mean and standard deviation, while the data obtained through counting were given as percentage (%). Statistical significance level was accepted as $p < 0.05$.

Results

In the study, of 143 patients who underwent vitreo-retinal surgery in the Eye Diseases clinic between April 30, 2018, and November 01, 2020, the data of 100 patients were accessed. It was found that 60 of these patients received total intravenous anesthesia (Group T) and 40 patients were administered desflurane anesthesia (Group D) (Fig. 1).

The patients' ASA risk scores, age, gender, body mass index, and surgery durations are presented in table 1, and no statistically significant difference was determined between the groups ($p > 0.05$).

In terms of the patients' heart rates and mean arterial pressure, no statistically significant difference was found between the groups (Figs. 2 and 3) ($p > 0.05$).

The patients' RASS scores are presented in table 2. Accordingly, emergence agitation levels of Group D at 0th min were significantly higher compared to Group T ($p < 0.001$).

Regarding the patients' extubation quality levels, extubation quality levels of the patients in Group D were found to be significantly higher compared to the patients in Group T ($p < 0.001$) (Table 3). Similarly, additional analgesic requirement levels of the patients in Group D were determined to be significantly higher compared to the patients in Group T ($p = 0.005$) (Table 3).

Discussion

The study in which we examined the effects of different anesthesia methods on emergence agitation has shown that TIVA method decreases post-operative emergence agitation and ensures a more comfortable recovery from anesthesia. This situation also contributes to better quality of extubation. In addition, this method reduces the patient's pain levels in the recovery period and keeps additional analgesic requirement at a minimum level, which helps the patients to experience the post-operative recovery period more comfortably and calmly.

In vitreoretinal surgery, different anesthesia methods such as TIVA, inhalation anesthesia, and local anesthesia are used, but when the literature was reviewed, no study on emergence agitation in these patients was encountered. As an important post-operative complication, emergence agitation can lead to surgical complications in patients who underwent vitreo-retinal surgery such as increase in intraocular pressure following extubation, venous ruptures as a

Table 1. Patient characteristics and duration of anaesthesia and surgery

Parameters	Group T (n = 60)	Group D (n = 40)
Age (year)	61.6 ± 11.9	60.7 ± 12.2
Gender (M/F)	34/26	15/25
Body mass index (kg/m ²)	28.6	29.2
ASA physical status (I/II/III)	9/27/24	4/15/21
Duration of anaesthesia (min)	90.5 ± 29.3	94.4 ± 27.9
Duration of surgery (min)	86.4 ± 22.4	91.7 ± 25.7
Extubation time (min)	4.5 ± 2.3	4.4 ± 2.1
Remifentanyl infusion (mcg/h)	653.5 ± 101.2	651.5 ± 123.3

ASA: american society of anesthesiologists classification. Values are expressed as mean ± standard deviation, number (n).

Table 2. Comparison of emergence agitation levels of the Groups

Emergence agitation (RAAS > +1)	Group T (n = 60)	Group D (n = 40)	p
0 min	0	7 (17.9%)	< 0.001*
15 min	0	0	
30 min	0	0	

* $p < 0.001$ Group D has higher emergence agitation levels than group T.
RASS: richmond agitation-sedation scale; min: minute.

Table 3. Continuous variables of study between groups

Outcome	Group T (n = 60)	Group D (n = 40)	p
Extubation quality score (1-5)	1.21 ± 0.64	1.77 ± 0.96	< 0.001*
Need for rescue medication (number of patients)	1 (1.6%) 2 (3.3%)	7 (17.9%) 2 (5%)	0.005*
Incidence of vomiting and nausea (number of patients)			

* $p < 0.001$, extubation quality score in group D are compared to group T.

result of increased pressure caused by gagging, and severe subchoroidal hemorrhages. In determining postoperative agitation, RASS is frequently used⁷.

Particularly, young age, male sex, and presence of obesity are independent risk factors, and in terms of demographic data, there was no significant difference between the groups in the present study³.

When the literature is reviewed in terms of the effects of different anesthesia methods to be used in surgical applications on emergence agitation, it is seen that the use of inhalation anesthesia in children is known to be a risk factor in terms of emergence agitation, but that there is limited data on adults^{3,6}. In a randomized controlled trial conducted by Chandler et al. on 112 patients who were operated for diplopia,

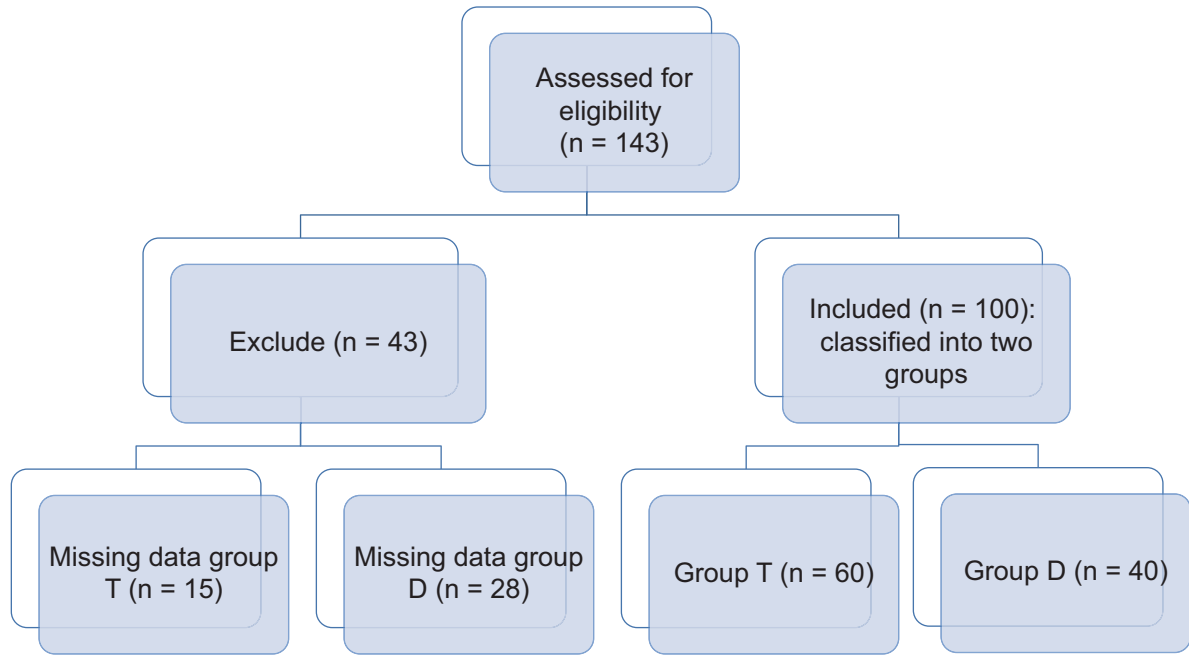


Figure 1. Consolidated Standards of Reporting Trials flowchart showing the number of patients at each phase of the study.

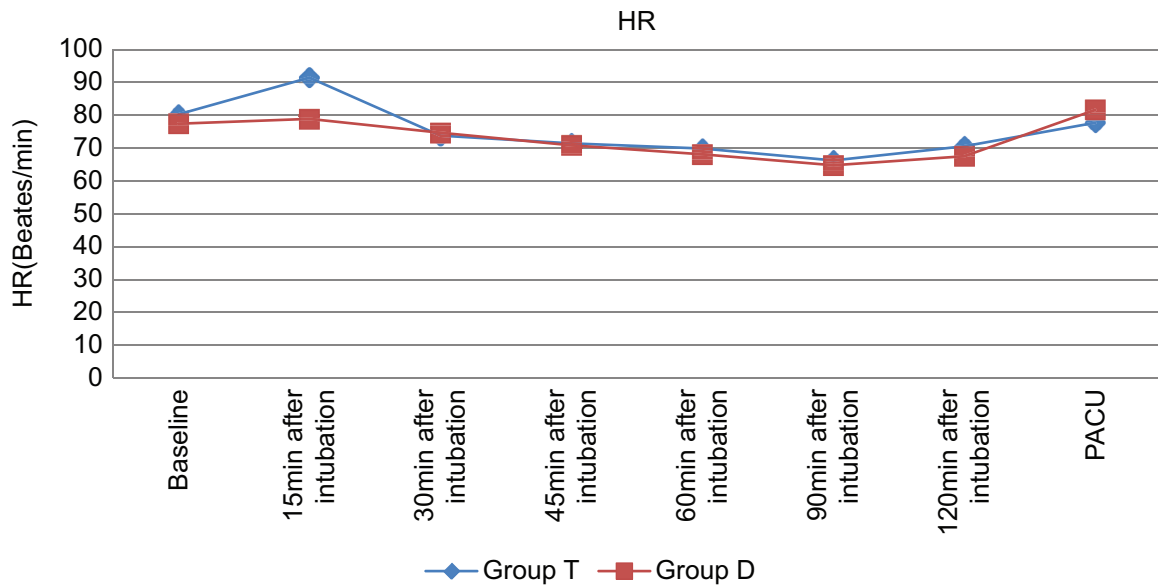


Figure 2. Changes in heart rate during surgery in groups.

Pediatric Anesthesia Emergence Delirium was used, and it was demonstrated that TIVA method reduced the incidence of agitation compared to inhalation anesthesia⁸.

In a prospective study conducted by Yu et al. on 2000 patients, agitation was followed up by a special nurse with a 3-point scale, and the incidence of

agitation was found to be lower in the group which was administered TIVA⁹. In addition, in a retrospective study conducted by Kim et al. on 792 patients, RASS $\geq +1$ was accepted to be statistically significant, and the incidence of agitation was found to be lower in TIVA group⁵. In the prospective randomized controlled clinical trial conducted by Jo et al. on

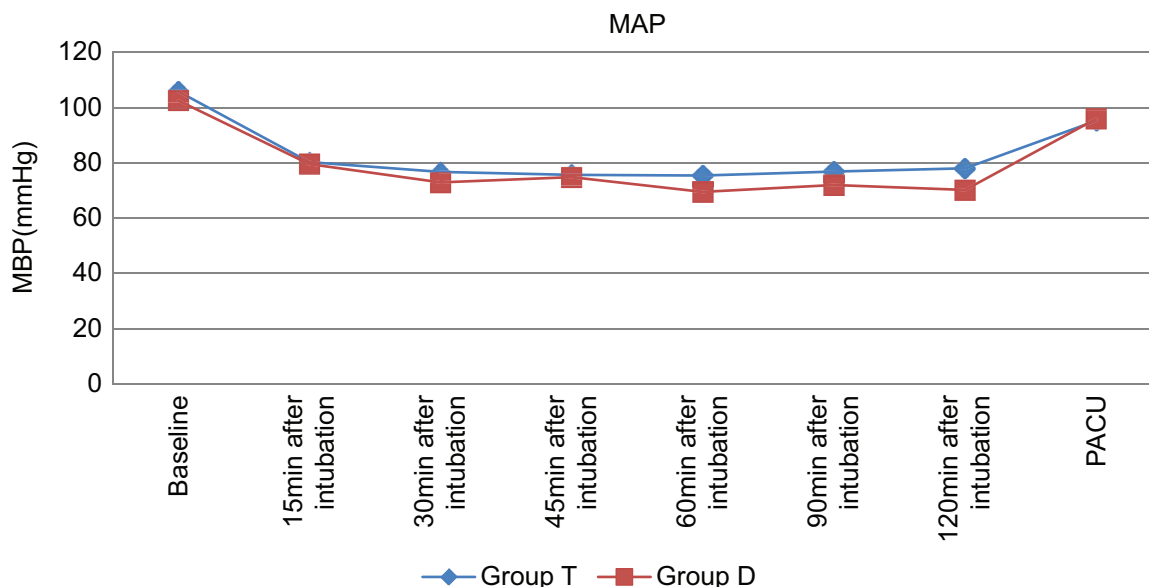


Figure 3. Changes in mean arterial pressure during surgery in groups.

80 patients, in addition to RASS, Riker Sedation Agitation Scale (RSAS) was used, RSAS > 1 was accepted to be statistically significant, and TIVA application was found to have decreased agitation incidence compared to the use of sevoflurane inhalation anesthesia¹⁰.

Although there are studies reporting results conflicting with the studies mentioned above¹¹, in our study, while no agitation was observed in any of the patients who were administered TIVA, determining RASS ≥ 2 at 0th min after extubation in 7 of the 40 patients was found to be statistically significant. This supports the finding that TIVA administration reduced agitation incidence.

As intracranial pressure increase, upper airway obstruction, and situations such as laryngospasm, hypoxia, and hypercarbia that may lead to orientation disorder can increase agitation, necessary measures should be taken and agitation development should be prevented¹². When extubation quality scores of the patients were compared in our study, extubation quality scores of the patients who were administered TIVA were found to be lower compared to the patients who were administered inhalation anesthesia, and the situation was found to be statistically significant.

The role of pain should not be ignored among the causes of postoperative emergence agitation. An adequate level of postoperative pain palliation has been demonstrated to decrease agitation incidence^{9,13-15}. However, there are studies which showed less consumption

of post-operative analgesics in patients who were administered TIVA^{16,17}. When the patient records in the present study were examined, it was seen that all patients were routinely administered 1 g paracetamol and 30 mg meperidine at the 45th min of the operation. In our study, while only one patient out of 60 patients who were administered TIVA needed additional analgesics, seven of the 40 patients who were administered inhalation anesthesia needed additional analgesics, and the difference was found to be statistically significant. This situation supports the finding that in addition to directly reducing agitation incidence, TIVA administration is effective in decreasing agitation induced by pain by reducing post-operative pain level.

Study limitations

Our study has certain limitations. First of all, nor being able to access all patient files due to the long time interval and lack of data in the files caused the number of patients to be limited. Second, as patient protocols and scoring systems contained subjective values as a result of different surgery and anesthesia teams performing the surgeries, a full standardization could not be achieved. Finally, it was observed that Bispectral Index Sensors, which are used to measure anesthesia depth in total intravenous anesthesia, were not used due to proximity to the surgical area.

Conclusion

It can be concluded that total intravenous anesthesia method decreases post-operative emergence agitation, ensures a more comfortable recovery from anesthesia for patients, and thus contributes to a better quality of extubation. In addition, it decreases the need for additional analgesics and helps patients to experience the post-operative recovery process more comfortably and calmly. Thus, complications that can develop depending on emergence agitation in patients who underwent vitreoretinal surgery during which intraocular pressure should not be elevated can be prevented. We believe that identifying more objective markers will be effective in predicting and preventing emergence agitation and that more prospective studies are needed in terms of predicting emergence agitation in adult population, making differential diagnoses, and determining the treatment.

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Conflicts of interest

The authors declare no conflicts of interest.

Ethical considerations

Protection of human and animals. The authors declare that no experiments involving humans or animals were conducted for this research.

Confidentiality, informed consent, and ethical approval. The authors have obtained approval from the Ethics Committee for the analysis of routinely obtained and anonymized clinical data, so informed

consent was not necessary. Relevant guidelines were followed.

Declaration on the use of artificial intelligence. The authors declare that no generative artificial intelligence was used in the writing of this manuscript.

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