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Original Research Article

Effect of Mild Cognitive Impairment (MCI) and MCI with Sleep Disorders on the Potency of Sevoflurane Anesthesia

Bhimani Heta Shaileshbhai[1], Rahul Datta Roy[2], Swapan Debbarma[3]

[*]MBBS, GMERS Medical College, Junagadh, Gujarat

[1]MBBS, GMERS Medical College, Junagadh, Gujarat

[2]Assistant Professor, Department of Anesthesiology, Agartala Govt. Medical College

[3]Assistant Professor, Department of Anesthesiology, Agartala Govt. Medical College

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Corresponding Author: Dr. Chandrala Kishan Kishorbhai[*]

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Abstract:

Background: The hallmark of mild cognitive impairment (MCI) is impairment in one or more cognitive domains, which might make it difficult to carry out daily tasks while retaining one's independence and autonomy. Lack of sleep has been demonstrated to affect the efficiency of general anesthetics in rats, resulting in delayed emergence from anesthesia or hypersensitivity to induction of anesthesia.

Aim: To analyze effect of mild cognitive impairment (MCI) and MCI with sleep disorders on the potency of sevoflurane anaesthesia

Method: The GMERS Medical College, Junagadh, Gujrat Hospital's Ethics Committee examined and authorized this clinical investigation. The patients and their families completed an informed permission form after being properly told about the study before it was carried out. Individuals between the ages of 60 and 75 who had a body mass index (BMI) between 18.5 and 23.9 kg/m² were chosen for unilateral radical mastectomy. The statistical program SPSS 26.0 was utilized to analyze the data. A two-sample t-test was used to compare groups, and measurement data with a normal distribution were displayed as mean ± standard deviation ($\bar{x} \pm s$).

Result: numbers of patient in both group M = 25 and MS = 26. The mean age of these group members was 65.22 ± 2.62 for M group and 64.31 ± 3.37 for MS group. Moreover, the BMI of these groups was 21.63 ± 1.32 for M and 21.36 ± 0.21 for MS. The analysis has also suggested MCH value which was 36.11 ± 3.12 for M and 22.24 ± 3.14 for MS group.

Conclusion: Patients with MCI and sleep issues received larger doses of sevoflurane than patients with MCI alone. We also found a correlation between serum MCH level and the sevoflurane MAC value.

Keywords: MAC, MCI, Sleep disorder, Sevoflurane

Introduction

The hallmark of mild cognitive impairment (MCI) is impairment in one or more cognitive domains, which might make it difficult to carry out daily tasks while retaining one's independence and autonomy [1]. Clinical observations have revealed that sleep problems, including insomnia, sleep fragmentation and sleep structural disorders are prevalent in the elderly [2, 3, 4]. The perioperative phase is usually affected by preoperative sleep problems, which can significantly alter the intraoperative anesthetic dosage. Moreover, the research indicates that individuals with sleep difficulties prior to surgery have a greater need for propofol during a painless gastroscopy, which results in higher infusion rates and plasma concentrations per unit of body surface area [5, 6].

Insomnia and other sleep disorders are frequently seen in clinics due to a disturbed environment, pain, anxiety or fear [7]. Postoperative complications such as delirium are more common in patients with sleep difficulties [8]. Lack of sleep has been demonstrated to affect the efficiency of general anesthetics in rats, resulting in delayed emergence from anesthesia or hypersensitivity to induction of anesthesia [9]. It is yet unknown, nevertheless, how sleep modifications impact general anesthesia [10]. A prior study demonstrated that rats exposed to sleep deprivation experienced longer awakening from isoflurane anesthesia due to a decrease in Orexin-A [11, 12]. Human confirmation of this notion is still pending. As a result, we postulated that sleep issues and alterations in orexin-A could influence the hypnotic effectiveness of anesthetics in people.

By focusing on the results of previous studies, the current study looked into the ideal intraoperative sevoflurane concentration for MCI and MCI patients who also had sleep issues. Using logistic regression, the study also examined the connection between

MCH and the body's reaction to sevoflurane anesthesia.

Aim

To analyze effect of mild cognitive impairment (MCI) and MCI with sleep disorders on the potency of sevoflurane anaesthesia

Methods

The GMERS Medical College, Junagadh, Gujrat Hospital's Ethics Committee examined and authorized this clinical investigation. The patients and their families completed an informed permission form after being properly told about the study before it was carried out. Individuals between the ages of 60 and 75 who had a body mass index (BMI) between 18.5 and 23.9 kg/m² were chosen for unilateral radical mastectomy.

Prior to surgery, all patients were required to fast. The person created peripheral venous access, breathed oxygen through the mask, and injected lactated Ringer's solution at a rate of 10 ml/kg as soon as they entered the room. The following parameters were tracked: nasopharyngeal temperature, electrocardiogram (ECG), pulse oxygen saturation (SPO2), end-tidal carbon dioxide concentration (ETCO2) and non-invasive blood pressure (NIBP). Sevoflurane was administered to induce anesthesia. The end-tidal sevoflurane concentration of the first patient in each group was established at 2.2% in this investigation using the Dixon up-and-down approach. The skin incision was started as soon as the concentration hit the predetermined level and stayed steady for at least fifteen minutes.

Inclusion and Exclusion Criteria

Inclusion

- Patient with mild cognitive impairment
- Having sleeping disorders

Exclusion

- Patients who refused to sing the consent paper
- Long term use of analgesics
- Recently used the anesthetics and psychiatric drug
- Having history of alcohol and drug abuse
- Diseases of other important organ
- Family history of malignant high fever

Statistical Analysis

The statistical program SPSS 26.0 was utilized to analyze the data. A two-sample t-test was used to compare groups, and measurement data with a normal distribution were displayed as mean ± standard deviation (x±s). Through the use of probit analysis, the MAC value and 95% CI of sevoflurane were determined. To examine the relationship between the likelihood of MAC and the hormone that concentrates melanin, logistic regression was used. The threshold for statistical significance was set at $P < 0.05$.

Results

Table 1: Group details with concentration of MCH

Parameters	M group (n=25)	MS group (n=26)	P value
Age	65.22 ± 2.62	64.31 ± 3.37	0.145
Height (cm)	158.40 ± 3.98	161.7 ± 3.52	0.267
Body weight (Kg)	52.04 ± 5.78	58.36 ± 3.89	0.09
BMI (kg/m^2)	21.63 ± 1.32	21.36 ± 0.21	0.09
ASA	1-2	1-2	
Education years	4.93 ± 1.28	5.01 ± 1.04	0.789
MCH (Pg/ml)	36.11 ± 3.12	22.24 ± 3.14	<0.00

The outcomes of results above have provided the information related to numbers of patient in both group M = 25 and MS = 26. The mean age of these group members was 65.22 ± 2.62 for M group and 64.31 ± 3.37 for MS group. Moreover, the BMI of these groups was 21.63 ± 1.32 for M and 21.36 ± 0.21 for MS. The analysis has also suggested MCH value which was 36.11 ± 3.12 for M and 22.24 ± 3.14 for MS group.

Table 2: Regression analysis

Independent variable	Regression coefficient	SE	OR	95% CI for OR	P value
MCH	-0.180	0.08	0.87	0.721-0.965	0.04
Constant	3.482	1.546	36.21		0.04

The incidence of body movement response during skin incision was found to be adversely connected with MCH concentration, according to the logistic regression model. The formula for logistic regression used to forecast movement reaction was P(movement response) = 3.482– 0.18 MCH, with an odds ratio (OR) of 0.87 (95% CI 0.721–0.965, P = 0.04).

Discussion

According to outcomes of current research, patients with MCI who experienced sleep disturbances needed higher sevoflurane MAC values and had lower serum MCH concentrations. Furthermore, we verified that there is a negative correlation between MCH and responses to body movement. As per the outcome of study of Cao et al., (2020) [13] the sleep-wake cycle is controlled by the orexin system. Lower levels of orexin-A indicate defective orexinergic signalling, which is the aetiology of narcolepsy. Arousal is affected by pharmacological and genetic inhibition of orexin-mediated signalling. On the other hand, orexin-A levels are higher in patients with insomnia disorders, which is in line with our findings. Additionally, prior research has shown a strong association between plasma orexin-A and either the Epworth drowsiness scale score or the arousal index. This connection emphasizes how important orexin is for sustaining alertness. Therefore, orexinergic neurons may also have an impact on general anaesthesia.

In the current investigation, the body movement reaction during skin incision was used to alter the sevoflurane's MAC value. According to the findings, sevoflurane's MAC value was approximately 1.43 in M patients and 1.93 in MS patients who had sleep difficulties. MCH and the enhancement of sleep are strongly correlated. MCH deletion mice showed less non-REM sleep and were more alert and active, according to Wil-lie and his colleagues. Moreover, the study of Wang et al., (2024) [14] has also found that Serum MCH levels and the incidence of body movement reactions during skin incision were found to be correlated by logistic regression analysis, demonstrating that MCH levels can affect the required sevoflurane MAC value for patients [15].

Conclusion

Our research concluded that sevoflurane dosages were higher for patients with sleep difficulties and MCI than for those with MCI alone. Additionally, we discovered a relationship between the sevoflurane MAC value and serum MCH content.

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