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RESEARCH

FACILITATE IN ELDERLY WAKING AFTER SURGERY WITH DEPTH OF ANESTHESIA MONITORING

ABSTRACT

Introduction: Bispectral Index monitoring improves the titration of anesthetic drugs and decreases the recovery time of general anesthesia. The aim of this study was to evaluate the effects of Bispectral Index monitoring on the recovery profile of elderly patients undergoing surgery with general anesthesia.

Materials and Method: In this randomized, single blind controlled trial, 68 elderly patients were enrolled. Blocked randomization was used to allocate the patients to 1 of 2 groups (intervention and control groups). In the Bispectral Index group, the inspiratory concentration of isoflurane was increased until the patient reached a Bispectral Index of 45-65. If a patient developed hypertension or tachycardia, 50 µg of IV fentanyl would be administrated. The time to regain consciousness was the primary outcome of the study and the extubation time and time of discharge from the post anesthesia care unit were the secondary outcomes.

Results: The mean extubation time in the Bispectral Index and control groups, in minutes, was 7.34±0.48 and 11.23±0.49, respectively. The mean time to regain consciousness was 20.2±0.79 in the Bispectral Index group and 29.91±1.31 in the control group. The average time of discharge from the postoperative care unit was 26.62±0.78 for the Bispectral Index group and 37.44±1.44 for the control group. All of the differences were significant (p<0.0001).

Conclusion: Measuring the depth of anesthesia by Bispectral Index monitoring improves the recovery time of elderly patients and accelerates their discharge from the postoperative care unit.

Key Words: Anesthesia; Anesthesia recovery period; Consciousness Monitors; Isoflurane.

ARAŞTIRMA

YAŞLILARDA CERRAHİ SONRASI ANESTEZİ DERİNLİĞİNİN ÖLÇÜLMESİ İLE UYANMANIN HIZLANDIRILMASI

Öz

Giriş: Bispektral Indeks monitorizasyonu anestezik ilaçların titrasyon artırır ve genel anestezi iyileşme süresini azaltır. Bu çalışmanın amacı, genel anestezi ile ameliyat olan yaşlı hastaların iyileşme sürecine Bispektral İndeks monitorizasyonunun etkilerini değerlendirmektir.

Gereç ve Yöntem: Randomize, tek kör kontrollü çalışmaya 68 yaşlı hasta dahil edildi. Hastaları müdahale ve kontrol gruplarına ayırmak için randomizasyon yöntemi kullanıldı.

Bispektral Indeks grubu hastalarında, indeks değeri 45-65 arasında bir değere ulaşana kadar, inspiratuar izofluran konsantrasyonu arttırıldı. Hipertansiyon ya da taşikardi geliştiğinde hastalara 50 mcg fentanil IV uygulandı. Araştırmanın birincil amacı bilincin yeniden kazanılması için geçen süre iken, ekstübasyon zamanı ve anestezi sonrası anestezi kliniğinden ayrılma süresi ikincil amaçlar arasında yer almıştır.

Bulgular: Bispektral İndeks ve kontrol gruplarında ortalama ekstübasyon süresi 7.34±0.48 ve 11.23±0.49 olarak saptandı. Bilincin yerine gelme süresi ise Bispektral İndeks grubunda 20.2±0.79 ve kontrol grubunda 29.91±1.31 dakika idi. Postoperatif bakım ünitesinden taburcu ortalama süre Bispektral İndeks grubunda 37.44±1.44, kontrol grubu için için 26.62±0.78 idi. Farklılıkların tamamı (p <0.0001) istatistiksel olarak anlamlı bulundu.

Sonuç: Bispektral indeks monitorizasyonu ile anestezi derinliğinin ölçülmesi yaşlı hastalarda iyileşme süresini artırır ve postoperatif bakım ünitesinden taburcu olmayı hızlandırmıştır.

Anahtar Sözcükler: Anestezi; Anestezi İyileşme Periyodu; Bilinç Monitörleri; Isoflurane.

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INTRODUCTION

Although rapid advances have been made in anesthetic techniques, they have many complications. Cardiac arrest, arrhythmia, hypotension, hypertension, aspiration, drug adverse effects, respiratory failure, bronchospasm, nausea, vomiting, wheezing, myocardial infarction, confusion, angina, pulmonary edema and altered mental status are some of these complications (1-4). Development of these complications in elderly patients undergoing major surgeries is very important and may lead to prolonged hospital stay, delayed functional recovery and increased health costs (1).

According to the results of a previous study, postoperative complications occur in 5% to 10% of patients of all ages while they occur in 10% to 15% of elderly patients. The incidence of these complications has been reported as 44% to 61% in another study (1,5). Reduction of anesthetic drug dose and the duration of anesthesia may decrease the incidence of these complications (6,7).

Minimizing the complications of anesthesia, reducing the recovery period and time spent in the post anesthesia care unit (PACU) and decreasing health costs are some of the goals of anesthesiologists (8).

The conventional method of monitoring of depth of anesthesia is based on heart rate, blood pressure, pupil size, pattern of breathing and body movements (9). However, many studies have suggested that bispectral index (BIS) improves the titration of anesthetic drugs and decreases the recovery time from general anesthesia (10-12). BIS is a parameter that is obtained from the electroencephalograph (EEG) and can be used to monitor the depth of anesthesia (13-15). On the other hand, other studies could not find any significant differences in the recovery profile of patients with general anesthesia using BIS (10,16-17). Therefore, we designed this study to evaluate the effect of BIS monitoring on the recovery profile of elderly patients undergoing surgery with general anesthesia.

MATERIALS AND METHOD

Patients

In this randomized single blind clinical trial, 68 patients aged over 60 years were enrolled. Patients with ASA (American Society of Anesthesiologists) class I-III who were candidates for elective abdominal surgery (normal healthy patients, patients with mild systemic disease and patients with severe systemic disease with no immediate danger of death) were included in the study. Patients with psychotic disorders, dementia, previous cerebrovascular accident, head trauma or drug abuse were excluded from the study.

Study Oversight

This study was approved by the ethics committee of Hamedan University of Medical Sciences. All of the patients provided an informed, written consent.

Study Design

This randomized, single blind controlled trial was conducted in Besat Hospital of Hamedan. Blocked randomization was used to allocate the patients to 1 of 2 groups with a 1:1 ratio. Electrocardiogram, pulse oxymetry and blood pressure meaures were used to monitor the patients.

In both groups, general anesthesia was induced by 2 μg/kg of fentanyl, 0.04 mg/kg of midazolam, 2 mg/kg of propofol and 0.5 mg/kg of atracurium. Isoflurane 1% or 2% (according to the depth of anesthesia), 4.5 liter nitroxide and 3.5 liter per minute oxygen were also used for anesthesia.

If the patients in the control group developed hypertension (20% increase in the initial blood pressure) or tachycardia (heart rate more than 100), the inspiratory concentration of isoflurane was increased or 50 μg of IV fentanyl was administered.

In the intervention group (BIS group), bipolar electroencephalographic leads (model: Danmeter – CSM I) that were connected to the temporal and frontal lobe areas of the patients were used. The BIS index was monitored before and during the anesthesia. In this group, the depth of anesthesia was evaluated by BIS index. A BIS index of 85-100 was considered as awake, 65-85 was considered as sedation, 45-65 was considered as general anesthesia, 30-45 was equivalent to deep hypnosis and a score below 30 represented burst suppression.

In the BIS group, the inspiratory concentration of isoflurane was increased until the patient reached a BIS index of 45-65 and if a patient developed hypertension or tachycardia, 50 μg of IV fentanyl was administered.

In both groups, 15 minutes prior to the end of the surgery, 1 μg of IV fentanyl was administered. At the end of the surgery, isoflurane and nitroxide were discontinued. After the patient started breathing, the neuromuscular block was antagonized by 0.05 mg/kg of neostigmine and 0.02 mg/kg of atropine. The patients were transferred to the recovery room after return of normal breathing and throat reflexes and increase of O_2 saturation to above 97% and after the muscle relaxants were antagonized.

One minute after the patient was transferred to the recovery room, the orientation of the patient to time, place and person was evaluated. After 15 minutes, an anesthesiologist who was not aware of the allocation process evaluated the patients using the Alderete's score and transferred the patients with a score higher than 9 to the surgery ward. On the following day, patients were asked about any memory of the surgery room and its events, or if they heard anything during the surgery.

The time to regain consciousness was the primary outcome of the study and the extubation time and time of discharge from the PACU were the secondary outcomes.

The age, sex, surgery time, the time between discontinuing isoflurane and extubating the patient, time consumed to transfer the patient to the recovery room, time of recovering from anesthesia and the time consumed by each patient in the recovery room were recorded. Data were analyzed by SPSS-18 using T-test, Kaplan-Meier and Log rank tests. P- values ≤ 0.05 were considered as significant.

RESULTS

In this study, 68 patients were enrolled. There were no significant differences in age, sex, height, weight and physical status between the control and intervention groups (p=0.0618 and p=0.792, respectively).

As shown in Table 1, the interval between discontinuing isoflurane and extubating the patients was significantly lower in the BIS group (p<0.0001).

The time in which the patients got ready to be transferred to PACU was also significantly lower in the BIS group (p<0.0001) (Table 1).

The mean time to regain consciousness in the intervention group was significantly less than in the control group (p<0.0001) (Table 1).

As shown in Table 1, the mean time spent by control group patients in the PACU was significantly higher than intervention group patients (p<0.0001).

DISCUSSION

Conventional methods for adjusting the depth of anesthesia may result in using too much anesthesia medication, which can lead to delay in the recovery and discharge of patients (6-8,10,18).

In the present study, BIS monitoring improved all the evaluated parameters in elderly patients. The average extubation time of the patients in BIS group was about 4 minutes less than the control group (7.34 vs. 11.23, respectively) and this difference was significant. In Gan and colleagues' study, the average time for extubation was 6.65 minutes for the BIS group and 14.34 for the control group and this difference was significant (19). In Recart and colleagues' study, the BIS group took 6 minutes to be ready for extubation while the control group needed an average of 11 minutes and this difference was also significant (11). Zohar and colleagues found no significant difference in the timing of airway device removal between the two groups (10).

In our study, patients in the BIS group spent an average of 9 minutes less to regain consciousness than those in the control group (20.2 vs. 29.91, respectively). Our results were consistent with Wong and colleagues' study (20). The time to regain consciousness was 13.1 minutes in the control group and 9.5 minutes in the BIS group, and they found this difference to be significant (20). Studies by Gan and colleagues and Recrat and colleagues also confirmed this result (11, 19). On the other hand, Zohar and colleagues found no significant difference in this matter (10).

The control group stayed in the PACU significantly longer than the BIS group (37.44 vs. 26.62 respectively). In Gan and colleagues' study, the BIS group was discharged from the postoperative care unit after 31.7 minutes while the control group spent an average of 43.85 minutes in the PACU (19). A meta-analysis by Liu showed that the average time spent in the PACU was 45.2 minutes for the BIS group and 49.1 for the control group. This difference was significant (21).

In Zohar and colleagues' study, the control group was discharged from the PACU room after 35 minutes while the BIS

Table 1— The Outcomes of the Study for Each Group.

	BIS Group (mean ± sd)	Control Group (mean ± sd)	Total (mean ± sd)	p-value
Extubation time, minutes	7.34 ± 0.48	11.23 ± 0.49	9.27 ± 0.41	p<0.0001
Transfer to PACU, minutes	12.08 ± 0.64	15.23 ± 0.71	13.66 ± 0.51	p<0.0001
Time to regain consciousness, minutes	20.2 ± 0.79	29.91 ± 1.31	25.05 ± 0.96	p<0.0001
Discharge from PACU, minutes	26.62 ± 0.78	37.44 ± 1.44	31.85 ± 1.06	p<0.0001

group stayed for 37 minutes. They found no significant differences between the two groups (10). Wong and colleagues also did not find any significant difference between the two groups in this matter (20).

Limitations of the Study

One of the limitations of this study was that we were not able to double blind. This leads to potential investigator bias. Also we did not record the dosage of drugs used for inducing anesthesia, the costs and the complications of the surgery. Although using BIS monitoring reduced the time of all outcomes of the study, to justify its routine use, it should be determined whether BIS monitoring can decrease health costs, improve patients' satisfaction or decrease the complications of surgery.

In conclusion, BIS monitoring of anesthesia depth improves the recovery time of elderly patients and accelerates their discharge from the postoperative care unit.

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