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RESEARCH ARTICLE

USE OF NEAR INFRARED SPECTROSCOPY MONITOR AND ITS RELATIONSHIP IN THE EARLY DETECTION OF POSTOPERATIVE DELIRIUM IN ELECTIVE SURGERIES OF GERIATRIC PATIENTS IN HOSGENAES

^{1,*}Reyes Martínez Daniela Ivette and ²Ramírez Segura Eduardo Homero

¹Resident of third year of Anesthesiology, Escuela de Posgrados de Sanidad Naval- Hospital General Naval de Alta Especialidad, Department of Anesthesiology, Secretaría de Marina- Armada de México

²Neuroanesthesiologist attached, Escuela de Posgrados de Sanidad Naval- Hospital General Naval de Alta Especialidad, Department of Anesthesiology, Secretaría de Marina- Armada de México

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ABSTRACT

Introduction: Postoperative delirium is a complication that frequently occurs in post-operative patients, both in cardiac and non-cardiac surgery, with the most affected being the elderly. Diagnostic criteria for delirium or cognitive impairment are documented in the Diagnostic and Statistical Manual of Mental Disorders (DSM-V). The incidence reported on this entity varies between 25-80%, and its diagnosis will depend on its definitions, forms of presentation, type of surgery and time of its evaluation in the postoperative period. Considering that society is being demographically transformed by the increase of older adults in our population, the need to maintain the functionality and the cognitive state after the anesthetic-surgical procedure of this vulnerable age group has become more important. The incidence reported on this entity varies between 25-80%, and its diagnosis will depend on its definitions, forms of presentation, type of surgery and time of its evaluation in the postoperative period. Considering that society is being demographically transformed by the increase of older adults in our population, the need to maintain the functionality and the cognitive state after the anesthetic-surgical procedure of this vulnerable age group has become more important. Based on what has been reported in the medical literature of the specialty, a close association of postoperative cognitive deterioration has been demonstrated with the administration of anesthetic agents, among other risk factors.

Objectives: It is to define if, through changes revealed through neuromonitoring with Near Infrared Spectroscopy (NIRS), factors that could be associated with the presentation of cognitive impairment in elderly patients undergoing a major surgical procedure can be detected early. Postoperative cognitive delirium is understood as: - condition characterized by alterations in memory, concentration, language comprehension and social integration, which in the short, medium or long term is reflected in the functional capacity of patients.

Material and Methods: A sample of 60 patients older than 70 years, undergoing elective major surgery, who underwent NIRS neuromonitoring, were evaluated and the cognitive function was evaluated through the Montreal Cognitive Evaluation (MoCA) in the postoperative period. Measures of central tendency, distribution and dispersion were determined (Smirnov-Kolmogorov test). Frequencies and percentages were calculated, Whitney Mann's U-test / chi squared, Mommy Ratio with 95% CI. The Stata version 13 program was used. Statistical significance was taken with a p value of less than 0.05, with a 95% confidence interval.

Results: Of the total sample obtained, 53.3% were women and 46.7% were men. The median age was 71 years. In relation to the service: General Surgery (30%), Orthopedics (28.3%) and Cardiology (20%). The type of anesthesia most frequently used was general anesthesia balanced 66.7%, followed by regional anesthesia (18.3%), and general intravenous anesthesia 15%. The surgical time had a median of 90 minutes, mean pulse oximetry saturation (SpO₂) was 95%; In the NIRS, 68.3% had adequate cerebral saturation levels, that is, above 90% or no more than 20% of variation in their baseline. The 33.3% of the sample showed some type of postoperative cognitive delirium, through the evaluation of MoCA.

There were no statistically significant differences in sex distribution, age and type of anesthesia between groups with and without cognitive deficit.

Conclusions: In recent years there has been a special interest in the investigation of postoperative delirium, since there is currently no specific and sensitive assessment scale, applicable to the patient undergoing an anesthetic-surgical procedure, given the characteristics that a patient (Type of surgery, anesthetic time, hemodynamic changes, transoperative cerebral hypoperfusion, perioperative haemorrhage, drugs used, to mention a few), such as the various risk factors that identify them.

INTRODUCTION

In the General Naval High-Frequency Hospital (HOSGENAES) of the Navy Department, elective major surgery is frequently performed on geriatric patients, based on

**Corresponding author: Reyes Martínez Daniela Ivette, Resident of third year of Anesthesiology, Escuela de Posgrados de Sanidad Naval- Hospital General Naval de Alta Especialidad, Department of Anesthesiology, Secretaría de Marina- Armada de México.*

type I and II monitoring and, more often than not without specific neuromonitoring, and as sole protection Cerebral blood pressure to preserve a cerebral perfusion pressure (PPP) dependent on mean arterial pressure, as well as, SpO₂ by pulse oximetry. In the Department of Anesthesiology of HOSGENAES has as its mission and vision the continuous improvement, being at the forefront with the acquisition of last generation equipment and continuous medical education for professional and patient benefit, among the objectives to

preserve the cognitive function, Hemodynamic and structural in each anesthetic-surgical procedure. Postoperative delirium occurs more frequently than can be assumed; however, it is an under-diagnosed entity, especially in the geriatric population, which has an important impact on morbidity and mortality. Among the factors that can negatively favor this: the inflammatory response and poor management of postoperative pain and variables that can "predict" we can mention: age over 70, alcohol use, poor cognitive status and / or previous, Hydroelectric, metabolic alterations, non-cardiac thoracic surgery and aortic aneurysm surgery, among others. In the HOSGENAES, a brain oximetry monitor has recently been acquired through Near Infrared Spectroscopy (NIRS), which adds to the multimodal neurological monitoring in our hospital; By means of this method one has a better control as far as the cerebral perfusion during the anesthetic procedures and one is in capacity to prevent or to avoid delirium and DCP, being a useful tool to avoid neurocognitive pathologies that negatively impact to the functional capacity many Times associated with a state of cerebral hypoperfusion.

BACKGROUND

Cognitive disorders following anesthesia-surgical event occur relatively frequently in those procedures of cardiac surgery, associated or not with the use of extracorporeal circulation pump, and the neurological alterations range from seizures, neurodevelopmental alterations in the case of Children, cerebral vascular events until brain death, so it is important to improve the techniques of multimodal neuro monitoring, in order to have useful information on cerebral perfusion. (Barrera, 2012, pp. 22-22)

One of the first reports on the origin of near-infrared spectroscopy (NIRS) was made in 1977 by Professor Franz Jöbsis at Duke University, who notes that near-infrared light was able to traverse the And the so-called chromophobic molecules are responsible for the different absorption spectra, thus describing that, due to the high degree of transparency of the brain and myocardial tissue, it is possible to measure the saturation of the tissues in real time through spectroscopy. (Guillen, 2014, pp. 133). Nevertheless, it was until 1985, when Ferrari et al. Report the first measurements of tissue saturation by near-infrared spectroscopy. In 1993 was approved the first commercial equipment called INVOS 3100, which has evolved until reaching the current monitor. (Guillen, 2014, pp. 133)

Through multiple studies, the correlation between NIRS (cerebral and somatic) values with the presence of cardiac markers such as lactate or venous oxygen saturation (ScvO₂) and perfusion of regional tissue in a variety of clinical scenarios has been demonstrated, showing that NIRS values from different organs show a close relationship between tissue saturation and the state of systemic perfusion. A study by Ni (BMC Anesthesiology) reports the relationship between NIRS and the presence of delirium in geriatric patients undergoing non-cardiac surgery (knee arthroplasty). The author reports that the group of patients who presented delirium had a reduction in brain saturation (SvO₂), a decrease in blood pressure, values of gasometries with a tendency to hypoxemia and acidosis, as well as various factors related to cerebral hypoperfusion. (Ni, 2015, pp.2-8) Postoperative delirium has been reported as the most common psychiatric disorder in post-anesthetic care

units, as well as in intensive care units between 10-72% in patients over 65 years of age, which has been seen to develop within The first 4 days and can occur even up to 4 weeks post-operatively (Theuerkauf, 2012, pp.148-155). NIRS is a noninvasive cerebral tissue oxygenation monitor, which has been used in the last 30 years for trans operative multimodal neuromonitoring, has been an important guide on brain and tissue perfusion; Within its technical considerations the NIRS uses near infrared light between 700 and 1,000 nm, the sensor is placed in the patient's front taking care that it is not in the middle line where the sagittal sinus is. (Barrera, 2012, pp. 22-23)

It consists of an infrared light source (adhesive patch) that adheres to the skin of the skull (See Figure 1); This patch transmits photons of light through the tissues of the skull and consists of two receptor sensors that discriminate the light reflected by the skin, muscle and dura mater of that reflected by brain tissue. The total hemoglobin content (pulsatile, non-pulsatile, oxygenated, non-oxygenated) in the microvascular beds (vessels less than 1 mm in diameter) is measured. (Barrera, 2012, pp. 22-23). The MoCA evaluation test is a screening test built in 2004 by the Canadian Health Research Institutes and Alzheimer's Dementia Societies (DTAs) in the same country; Led by Universities of Múgil, Montreal, Sherbrook, Concordia and UCLA, and directed to the detection of mild cognitive dysfunctions and demential syndromes. (Pereira, 2013, pp. 39-61)

OBJECTIVES OF THE STUDY

The purpose of this study was to determine if the postoperative delirium presented the geriatric patients who underwent major elective surgery in the HOSGENAES. The correlation between a Montreal Cognitive Impairment Assessment (MoCA) and NIRS values in the trans operative period, patients were older than 70 years, and the objective of the study was to detect postoperative delirium. Detect those risk factors that lead to the presentation of this entity, in order to consider them and structure strategies aimed at reducing the risk of presenting it.

MATERIALS AND METHODS

The pre-anesthetic room sample was determined by applying the MoCA test (see Annexes), clinical history in patients older than 70 years who underwent major elective surgery, previous signing of informed consent, explained the anesthetic procedures to be performed, In the operating room, monitoring was performed: placement of electrocardiogram (five leads), pulse oxymeter, noninvasive blood pressure, invasive blood pressure (as appropriate), and NIRS monitor sensors were placed in the frontal region of the skull To be subsequently connected to the monitor INVOS Cerebral Oxymeter / Somatic Mod. 5100CC, a basal value was taken and at the end the average tran soperative was recorded, the variables were taken from the data collection sheet, once the procedure was completed, the test was performed MoCA at 48 hours and the alterations in the cognitive functions of each patient were registered. We performed a descriptive analysis of the information using simple frequencies and percentages for numerical variables and median with standard deviation range for the numerical variables, because they presented anormal distribution, according to the Kolmogorov-Smirnov test.

The frequency of cognitive deficit was obtained according to the MoCA test, with confidence intervals to 95% (95% CI). In the bivariate analysis, the distribution of the variables in the groups with and without cognitive deficit was evaluated. The Whitney Mann U test was used for the numerical variables, while the qualitative variables were evaluated using the X2 test. A multivariate analysis was performed using a nonconditional logistic regression model to evaluate the association between variables and cognitive deficit. Mommy Ratios (MRI) with 95% CI were calculated. For all tests, a value of $p < 0.05$ was considered statistically significant. Statistical analysis was carried out using the Stata version 13 program.

RESULTS

A total of 60 adult subjects older than 70 years, who underwent elective surgery in HOSGENAES, were included. 53.3% were women and 46.7% were men. The median age was 71 years. The service with the highest number of subjects was General Surgery (30%), Orthopedics (28.3%) and Cardiology (20%). The most frequently used type of anesthesia was Balanced General Anesthesia (66.7%) followed by Regional Anesthesia (18.3%), while General Endovenous Anesthesia was performed in 15% of subjects. The surgical time had a median of 90 minutes (see Table 1).

Table 1. General characteristics of subjects included in the study

Characteristic	n=60
Gender	
Male	28 (46.7)
Female	32 (53.3)
Age in years	71 ± 4.5
Surgical Service	
General Surgery	18 (30)
Orthopedics	17 (28.3)
Cardiology	12 (20)
Urology	11 (18.3)
Plastic surgery	2 (3.3)
Type of Anesthesia	
Balanced General Anesthesia	40 (66.7)
Regional Anesthesia	11 (18.3)
Endovenous General Anesthesia	9 (15)
Surgical time in minutes	90 ± 188.5

Data is displayed as number or median ± DE

Table 2. Transoperative characteristics of the subjects included in the study

Characteristics	n=60
Number of amines received	
Any	43 (71.7)
1 to 2	15 (25)
3 or more	2 (3.3)
Transfusions received	
Yes	0 (0)
No	60 (100)
Oxygen saturation	
Yes	58 (96.7)
No	2 (3.3)
Acid-base imbalance	
Yes	17 (28.3)
No	43 (71.7)
Transoperative Measurements	
SpO2 (%)	95 ± 6
Seric Lactate mmol/L	1.5 ± 1
Mean arterial pressure mmHg	65 ± 15
Average heart rate, lpm	67 ± 20.5
Intraoperative bleeding mL	450 ± 375

Source: Own elaboration.
Data is displayed as number (%) or median ± DE

Table 3. Results of Cerebral Perfusion, in the subjects included in the study

Characteristic	n=60
Cerebral Perfusion, %	85.5 ± 14.5
Cerebral perfusion category	
Low perfusion	2 (3.3%)
Moderate perfusion	17 (28.3%)
Adequate perfusion	41 (68.3%)

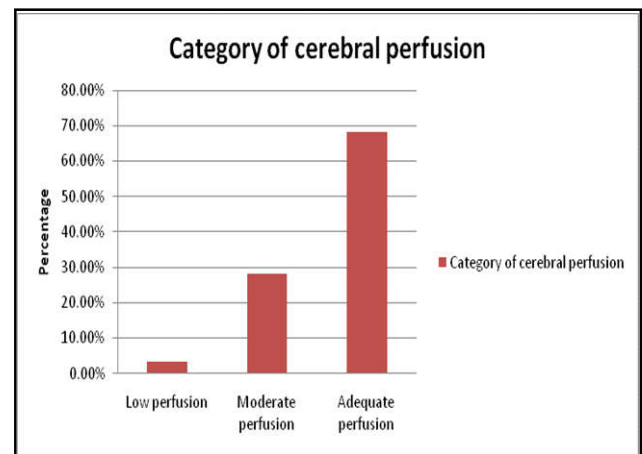
Table 4. Characteristics associated with the presence of Cognitive Postoperative Delirium

	delirium	N	Media	Desviación tip.	Error tip. de la media
SpO2	normal	40	95.13	2.691	.425
	anormal	20	96.30	4.028	.901
Aproximate bleeding	normal	40	397.25	229.120	36.227
	anormal	20	529.00	304.283	68.040
MAP	normal	40	68.08	13.988	2.212
	anormal	20	66.20	10.778	2.410
Heart Rate	normal	40	68.15	12.536	1.982
	anormal	20	67.55	17.212	3.849
Cerebral perfusion	normal	40	81.300	12.5068	1.9775
	anormal	20	81.400	10.8841	2.4338

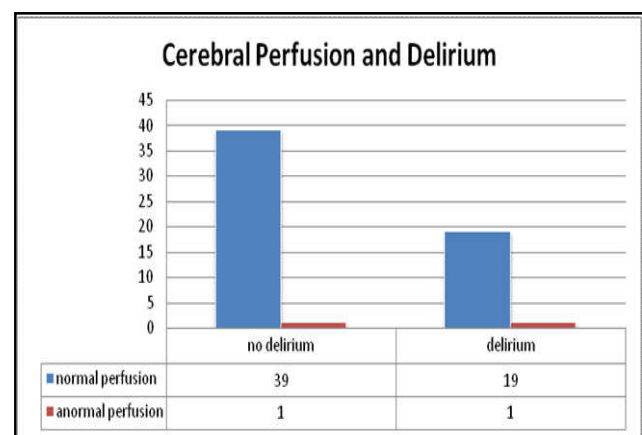
Source: Own elaboration.

Data is displayed as number (%) or media.

Note: Data are shown as means associated with presence of cognitive delirium



Graph 1. Distribution of the cerebral perfusion categories, in the subjects participating in the study



Graph 2. Cerebral Perfusion according to the presence of Delirium (Measured through the MoCA Test)

Regarding the transoperative characteristics of the subjects, 71.7% did not require amines, none received blood transfusions, 96.7% presented adequate saturation and 28.3% presented acid-base imbalance.

The median of the trans-operative measurements were 95% for SpO₂, serum lactate 1.5 mmol / L, mean arterial pressure 65 mmHg, heart rate 67x/y for transoperative bleeding 450 mL (see Table 2). The median cerebral perfusion was 85.5. 68.3% of the subjects had adequate perfusion, 28.3% moderate and 3.3% low perfusion (see Table 3 and Graph 1) In the final step of the analysis, the means of the transoperative characteristics were compared, however, no statistically significant results were obtained Table 4.

DISCUSSION

In this study, the association between NIRS values and postoperative delirium was proposed in patients older than 70 years who were scheduled for elective surgery, however, no significant correlation was observed between these two variables. Neither in their study (Ni, 2015, pp. 2-8), conclude that the cerebral saturation value was lower in those patients who presented postoperative delirium in relation to those who did not present it, compared with our study, the cerebral perfusion represented For the cerebral saturation value was not statistically significant in relation to that reported in the literature, which may be the cause of patient follow-up, since a large part of delirium occurs even weeks later and in this study was measured only in The postoperative. Among normal and abnormal brain perfusion levels, the analysis indicates a statistically significant difference between these two. It is important to note that in the abnormal brain perfusion group only two cases were reported, no statistically significant changes were found in the results regarding cerebral perfusion levels and the presence of postoperative delirium. One of the contributions of our study was that the results of the MoCA test were compared by subscales, so that we could see that patients with cognitive impairment found that the cognitive function most affected was visuospatial, with statistically significant results, Compared with the other cognitive functions studied. (Theuerkauf, 2012, p.150) In the literature consulted to assess cognitive status and to determine the presence or absence of postoperative cognitive impairment, they only use various scales such as the minimal, CAM-ICU among others and only refer to it as presence or absence without Specify cognitive function.

Conclusion

The need to know this pathology in depth will allow us in the future to have as an anesthesiologists a much broader picture, the specific objective being to have a scale with greater specificity and sensitivity for our patients, to avoid confusion

and misdiagnosis as delirium And to underestimate all other factors associated with the effect of anesthesia, especially in the most affected populations such as the extremes of life.

Although the NIRS value as a cause associated with postoperative delirium is not demonstrated in our study, I can conclude that NIRS is an additional tool of great value as it provides accurate and objective information about the state of the disease. Cerebral perfusion. The importance is to give our elderly patients the benefit of multimodal monitoring and multidisciplinary care, to keep in mind and consider the potential risk that patients have to develop a cognitive dysfunction that can be from mild to severe affecting their performance and functional capacity at Perform their activities of daily living. Not to diminish importance to each one of the factors of risk that contributes to that this pathological entity presents itself, and in case that we can identify it, to act in a timely manner. So that the research line could be continued for future studies on scales that allow us to detect postoperative cognitive impairment in a post-anesthetic-surgical patient in a timely manner.

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