

Postoperative Delirium is Common in the Elderly Patient, Before and After their Surgical Event is Related to Increased Mortality and Prolongation of Hospital Stay

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ABSTRACT

Objective: To evaluate Delirium and the patient's state of consciousness as risk factors after a surgical event, establishing a prognosis for the patient's hospital process, determining the severity of the patient's condition. **Method:** From the registry of patients of the Neurology and Geriatrics services, patients over 65 years of age who meet the selection criteria and from the clinical record to their neurological risks (predisposition to delirium) will be selected, recording the variables: age, sex, weight, height, BMI and previous cognitive activity. The statistical program Excel for Windows will be used.

Results: In this study, a total of 50 patients with a mean age of 70.8 (± 7.1) years were included. By sex, 60.0% (30) were women and 40.0% were (20) men. The patients underwent gastrointestinal-abdominal (34%), orthopedic (26%), urological (16%), cardiovascular (12%) and other (12%) surgeries. DPO was detected in 22 (44.0%) patients, subsequently no significant differences by age and sex were found. The variables associated with DPO were duration of surgery (OR = 1.04 [95% CI 1.01-1.06, $p = 0.004$]) and the presence of elevated intraoperative glucose levels (OR = 1.02 [95% CI 1.00-1.04, $p = 0.049$]).

Conclusions: DPO is a frequent complication in the elderly, which is why an opportune diagnosis and the implementation of prevention strategies are needed for this population. DPO is a frequent complication in the elderly, which is why an opportune diagnosis and the implementation of prevention strategies are needed for this population.

Keywords: impairment; surgical; evaluation; neurological

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Delirium Postoperatorio reportado en pacientes adultos mayores en Centro Hospitalario en la Ciudad de México

RESUMEN

El delirium postoperatorio es común en el paciente adulto mayor, antes y posterior a su evento quirúrgico se relaciona al incremento de la mortalidad y prolongación de la estancia hospitalaria.

Objetivo: Evaluar el Delirium y estado de consciencia del paciente como factores de riesgo posteriores a un evento quirúrgico, estableciendo un pronóstico para el proceso hospitalario del paciente, determinando la gravedad del estado del paciente. **Método:** Del registro de pacientes de los servicios de Neurología y Geriátrica se seleccionarán a pacientes mayores de 65 años que cumplan con los criterios de selección y del expediente clínico a sus riesgos neurológicos (predisposición para delirium) registrando las variables: edad, sexo, peso, talla, IMC y actividad cognitiva previa. Se utilizará el programa estadístico Excel para Windows. **Resultados:** En este estudio, se incluyó un total de 50 pacientes con una edad promedio de 65 (\pm 7.1) años. Por sexo, 60.0% (30) fueron mujeres y 40.0% fueron (20) hombres. Los pacientes fueron sometidos a cirugías gastrointestinales-abdominales (34%), ortopédicas (26%), urológicas (16%), cardiovasculares (12%) y otras (12%). El DPO fue detectado en 22 (44.0%) pacientes, posteriormente no se encontraron diferencias significativas por edad y sexo. Las variables asociadas con DPO fueron duración de la cirugía (RM = 1.04 [IC 95% 1.01-1.06, p = 0.004]) y la presencia de niveles elevados de glucosa intraoperatoria (RM = 1.02 [IC 95% 1.00-1.04, p = 0.049]). **Conclusiones:** El DPO es una complicación frecuente en el adulto mayor, por lo que se necesita un oportuno diagnóstico y la implementación de estrategias de prevención para esta población. El DPO es una complicación frecuente en el adulto mayor, por lo que se necesita un oportuno diagnóstico y la implementación de estrategias de prevención para esta población.

Palabras clave: deterioro; quirúrgico; evaluación; neurológica

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INTRODUCTION

Numerous diseases require surgery as treatment, either emergency or elective. Surgeries can have various complications; however, possible postoperative cognitive alterations are not considered: anesthetic awakening delirium and postoperative delirium (POD).

Postoperative Delirium (POD) is defined as an alteration in memory or thought that is corroborated by neuropsychological tests and is currently recognized as a frequent and serious complication. The incidence varies depending on age and the surgical procedure.

They are quoted; during the evaluation described in the review article of the Neuropsychiatry Journal of Peru; where postoperative delirium is classified as: "is a condition characterized by alterations in memory, concentration, language comprehension and social integration". (1).

These two entities have a negative impact on the patient's prognosis, functional capacity, cognitive function, days of hospital stay, costs, and mortality.

It is mentioned in the Mexican Journal of Anesthesiology, Postoperative Delirium, which is defined (POD): "a clinical syndrome characterized by alterations in memory, concentration, attention, comprehension language and social integration after the use of anesthetics and a surgical event; that persists three months after the surgery. (2).

In Mexico, the adult population is shaping up towards collective and active aging similar to developed countries, estimating that 21% of Mexicans will be over 65 years of age by 2025, eventually representing a need for medical care for this age group in the coming years. It is expected that in the next five decades the birth rate will drop, as well as the mortality rate. The latter registered a rate of 5 deaths per 1,000 inhabitants in 2010, and that will subsequently increase to reach 8.8 deaths per 1,000 inhabitants in 2050. (3)

An incidence of POD in cardiac surgeries of 30-80% in the first weeks and 10-60% at 3-6 months has been reported. In the case of non-cardiac surgeries, the incidence is estimated between 7% and 26%, it is approximately 25.8% a week and 9.9% three months after the procedure. (4).

The mechanism of injury is basically summarized as peripheral substances, such as adenosine triphosphate, alarmins, and cytokines, which arise at a site of injury or are increased in response to systemic inflammation, enter the brain through the blood-brain barrier. previously altered by the state

of inflammation and, (5) in this way, lead to the activation of microglia (central nervous system macrophages) that come out of their resting state to take an active role. (6).

Upon exposure to noxious stimuli, these primed neuronal tissues release a cascade of inflammatory cytokines and mediators, resulting in neuronal injury, which may include damage to the blood-brain barrier. This damage to the blood-brain barrier and the production of inflammatory mediators can culminate in postoperative cognitive decline. (7)

Demographics

DPO is more common in patients aged 65 years or over, with deteriorated functional status, abnormal blood pressure, electrolyte abnormalities, glycemia, a history of alcoholism, undergoing major cardiovascular, orthopedic, or thoracic surgery, etc., which entail a high blood loss (hematocrit < 30%), multiple transfusions and acute pain; POD also occurs in patients who during surgery show hemodynamic changes, bradycardia, tachycardia and hypoxemia.

Reported data for DPO vary from 9 to 87%, and depend on age, the type of surgery performed and the comorbidity present. The degree of surgical stress seems to be related to the incidence of DPO.

Assessment of the functional status of the patient

The corresponding batteries and tools must be applied to the patient, in order to be able to have and describe the cognitive and functional state of the patient and according to the type of surgical event, to be able to make the corresponding prediction in order to determine the prognosis.

At 6 months after the intervention, there was a significant decrease in development capacities of ADL and IADL. Of the patients without POD, 54.4% recovered an acceptable level of autonomy for BADL (independent or mild dependence), while in patients with POD it was only 1.1%; some studies place this gain at 6 months between 33 and 75%. (8).

Differences greater than 30 points were observed in the Barthel index in both groups, this increase being more pronounced in patients with POD; This increase represents a change from mild to moderate dependence in the case of patients without POD, and to severe dependence in patients with POD. The statistically significant differences between the two groups were maintained at 6 months. (9).

Regarding IADL, only 13% of the group of patients without POD recovered a level of independence or mild dependence. (10).

Tools for the diagnosis of Postoperative Delirium

In order to carry out the corresponding preoperative assessment, there are neuropsychological tests, which have to be and should be applied in the preoperative phase several days before the surgical event, this to avoid an underestimation of the baseline cognitive performance of The Confusion Assessment Method (CAM) is a standardized evidence-based tool that enables non-psychiatrically trained clinicians to identify and recognize delirium quickly and accurately in both clinical and research settings. The CAM includes four features found to have the greatest ability to distinguish delirium from other types of cognitive impairment. There is also a CAM-ICU version for use with non-verbal mechanically ventilated patients (See Try This:® CAM-ICU). The CAM-S is a companion tool to the CAM that can be used to assess the severity of delirium (Inouye, Kosar, Tommet et al., 2014). (11)

Both the CAM and the CAM-ICU have demonstrated sensitivity of 94-100%, specificity of 90-95% and high inter-rater reliability (Oh, Fong, Hsieh, & Inouye, 2017). Several studies have been done to validate clinical usefulness. (12).

The CAM may be incorporated into routine assessment and has been translated into several languages. The CAM was designed and validated to be scored based on observations made during brief but formal cognitive testing, such as brief mental status evaluations. The screening tool alerts clinicians to the presence of possible delirium. A positive screening test result should lead to further investigation. (13).

MATERIAL AND METHODS

The pathophysiological mechanisms involved include the degree of physical exercise, nutritional status, hormonal changes, age-related increase in cytokines that act on mechanisms such as oxidative stress, muscle protein turnover, loss of alpha motor neurons, apoptosis, among others; which will depend on the primary or secondary etiology of sarcopenia.

The evaluation of cognitive function in the perioperative period is essential for its diagnosis, since the manifestations of POD can present days and/or weeks after the surgical event. (14)

The risk of developing delirium is significantly increased in patients undergoing: 1) cardiothoracic surgery, 2) emergency orthopedic procedures, 3) cataract extraction, 4) in intensive care units, and 5) oncology services, with an incidence of 45% and prevalence of 42%. (15)

In the bivariate analysis of the intraoperative characteristics between patients without and with DPO, significant differences were found in the variables: duration of surgery, bleeding volume, blood glucose levels, higher frequency of intraoperative hypotension and bradycardia, higher frequency of catheter use and intraoperative transfusion.

A cross-sectional, observational, prospective study was carried out that included 50 adult patients aged 70 years and over who underwent balanced general anesthesia at the National Medical Center November 20th in the period from April to June 2023. non-probabilistic convenience sampling with adults who met the selection criteria during the study period. Men and women 65 years of age or older, who were extubated at the end of surgery, and who maintained their ability to communicate verbally, were included. Patients with a previous history of dementia, brain damage, cerebrovascular disease, drug abuse or intracranial surgery, presence of pain, those who presented respiratory crises (hypoxemia), hemodynamic crises (hypotension, arrhythmias), as well as those who presented a pain score ≥ 5 points in the postoperative period, since pain is a potential risk factor for delirium and can act as a confounding factor¹⁶. Of 50 patients evaluated, four were excluded for having presented pain ≥ 5 points in the postoperative period, with a participation response rate of 92.6%.

Patients underwent balanced general anesthesia according to the standard procedures of the Department of Anesthesia, as follows: premedication with midazolam 0.03 mg/kg; induction with propofol 2 mg/kg and fentanyl 5 μ g/kg; followed by neuromuscular block to facilitate endotracheal intubation based on cisatracurium 0.1 mg/kg. Sevoflurane 2% or desflurane 6% was used as the inhaled agent, at the choice of the anesthesiologist, to achieve and maintain a minimum alveolar concentration (MAC) of 1. All patients received ketorolac 30 mg postoperatively to keep the patient free of pain. In the recovery room, all patients received oxygen at 3 L/min, with monitoring of vital signs: heart and respiratory rate, blood pressure, temperature, and oxygen saturation.

The proposed study does not contemplate any intervention, only information recorded in clinical records and in consultations with hospitalized patients will be evaluated. With the following inclusion criteria: Male and female patients over 65 years of age treated at the Neurology and Geriatrics service of the National Medical Center November 20th.

Mentioning with the exclusion criteria: Patients with cancer or any disease of the musculoskeletal system.

The characteristics of the patients that were recorded were: age, sex, type of surgery performed, duration of surgery, volume of bleeding, type of inhaled anesthetic used, comorbidities, hypotension, bradycardia, use of catheters, transfusion requirement. Intraoperative, the presence of intraoperative electrolyte abnormalities and intraoperative glucose, hematocrit and hemoglobin levels.

Confusion Assessment Method. The CAM instrument has been used in over 4,000 original articles to date, as either a process or outcome measure, and has been translated into over 14 languages worldwide. When validated against the reference standard ratings of geriatric psychiatrists based on comprehensive psychiatric assessment, the CAM had a sensitivity of 94-100%, specificity of 90-95%, and high interobserver reliability in the original study of 50 patients (Inouye, 1990). More recently this work has been extended (Wei, 2008), and in 7 high-quality validation studies on over 1,000 subjects, the CAM had a sensitivity of 94% (95% CI 91-97%) and specificity of 89% (95% CI 85-94%).

Delirium Screening Tool: Confusion Assessment Method (CAM)

Feature 1: Acute onset and fluctuating course

This feature is usually obtained from a family member or nurse and is shown by positive responses to the following questions:

Is there evidence of an acute change in mental status from the patient's baseline? Did the (abnormal) behaviour fluctuate during the day, that is, tend to come and go, or increase and decrease in severity?

Feature 2: Inattention

This feature is shown by a positive response to the following question:
Did the patient have difficulty focusing attention, for example, being easily distracted, or having difficulty keeping track of what was being said?

Feature 3: Disorganized thinking

This feature is shown by a positive response to the following question:
Was the patient's thinking disorganized or incoherent, such as rambling or irrelevant conversation, unclear or illogical flow of ideas, or unpredictable switching from subject to subject?

Feature 4: Altered level of consciousness

This feature is shown by any answer other than “alert” to the following question: Overall, how would you rate this patient’s level of consciousness? Alert (normal), vigilant (hyper-alert), lethargic (drowsy, easily aroused), stupor (difficult to arouse), or coma (unarousable).” (16)

After the authorization of the protocol by institutional committees, from the registry of patients of the Neurology and Geriatrics service, patients over 65 years of age who meet the selection criteria will be selected and from the clinical record we will record the following variables: age, sex, volume of bleeding, preoperative anemia (< 11 g/dL), systolic blood pressure (BP) < 90 mmHg, diastolic < 50 mmHg, or mean arterial pressure (MAP) < 60 mmHg, or systolic BP > 140 mmHg, diastolic > 90 mmHg, heart rate > 100 or < 50 beats per minute, use of catheters, intraoperative transfusion, intraoperative electrolyte abnormalities, intraoperative glucose, hematocrit, and hemoglobin were analyzed using multiple logistic regression models, calculating the odds ratio. (RM) as a measure of association and its 95% confidence interval (95% CI). Subsequently, the diagnosis of the model was carried out using the Hosmer-Lemeshow goodness-of-fit test. For hypothesis tests, $p < 0.05$ was considered significant.

It will be used in the statistical program Excel for the Windows operating system.

This study was carried out in accordance with the Official Mexican Standard NOM-012-SSA3-2012, which establishes the criteria for the execution of research projects for health in humans, as well as the latest amended Declaration of Helsinki in October 2013.

This research project was submitted to the Ethics and Research Committee of the CMN Hospital on November 20.

In accordance with the regulations of the Health Law on research, Chapter 1, Second Title, Article 17, Section II on aspects of research in human beings, research with minimal risk was considered.

All subjects included in the protocol required informed consent by the patient or guardians once they were notified about the nature of the protocol, risks and benefits. Likewise, they were granted a copy of the declaration of privacy and protection of personal data in possession of third parties, with the freedom to annul the consent at the time requested as stated in Chapter I, Article 18.35

Biosecurity Considerations

The study will comply with the regulations of the general health law on research, second title, chapter 1, article 17 referring to “risk-free research” since it is a study that includes retrolective documentary research.

RESULTS

A total of 50 patients with a mean age of 65 (\pm 7.1) years were included. By sex, 60.0% (30) were women and 40.0% (20) men. By age group, 46.0% were 60-69 years old, 36.0% 70-79 years old, and 18.0% 80 or older. 54.0% of the patients had systemic arterial hypertension and 42.0% diabetes mellitus. The patients underwent gastrointestinal-abdominal (34%), orthopedic (26%), urological (16%), cardiovascular (12%) and other (12%) surgeries.

DPO was detected in 22 (44.0%) patients, by gender 59.1% (13) women and 40.9% (9) men ($p = 0.907$). By age groups (60/69 years and ≥ 70 years) the percentages were 40.9% (9) and 59.1% (13), respectively ($p = 0.522$). No significant differences were found between DPO according to the type of surgery performed (gastrointestinal-abdominal vs. urological vs. orthopedic vs. cardiovascular vs. others).

CONCLUSIONS

In order to improve the patient's conditions, it is necessary to maintain close surveillance during the pre- and postoperative period.

Neuropsychological tests must be standardized, which have and must be applied in the preoperative phase several days before the surgical event, specifically one week before surgery and later one month after the surgical event and a period no longer than 3 months for a second evaluation. It is important to mention that the follow-up of the postoperative patient must have a physical and cognitive rehabilitation plan, in order to improve the prognosis of said patient. At the same time, the patient must be accompanied during the hours subsequent to said procedure, to avoid acute confusional syndrome or delirium, which worsen the patient's conditions. Various mental training measures should also be established, such as memory games, music and cognitive development by the family, to reduce the progression of said cognitive deterioration. Different strategies must be adopted that allow increasing functionality in the elderly and establishing a family support network that reinforces integrity in the elderly patient. however, it is necessary to carry out the corresponding preoperative assessments as far

as the moment of performing surgical interventions is concerned, being able to determine if surgical intervention is feasible or not, seeking the benefit of the patient.

The type of surgery more related to postoperative delirium it is the valve replacement of mitral and valve stenosis. However, it is necessary to carry out the preoperative evaluation and follow the indications to prevent the development of postoperative delirium.

DISCUSSION

The situation to determine is the confidence interval, which exists in the preoperative assessment scales, because they are established parameters that are applied in a computer, which are already pre-established by statistical data at a global level. However, it must be taken into account that the Mexican population has its characteristics at the physiological level, and therefore at the level of both chronic-degenerative disease and surgical events. It is up to geriatric doctors to determine the physical and morbidity and mortality status of the older adult that exists and who arrives for an assessment in order to improve their quality of life.

Analyzing the corresponding risk factors of the preoperative assessment scales and the nutritional status of the patients (frailty), before and after their surgical event. However, different parameters are established in order to assess the state and condition of the elderly.

Advanced age has an impact on weight loss and the loss of lean mass or muscle strength, depending on the physical state of the patient, decreasing functional capacities. However, the same aging process applies to the cognitive state of the elderly patient, which together with a disease process can decrease and more in a surgical event, so it is vitally important to establish various strategies to diagnose such deterioration to prevent its progression during the pre and postoperative process. Patients and family members should be informed about the current condition, as well as how to deal with subsequent delirium within hours of surgery. In addition, measures must be established to prevent the development of delirium, such as accompanying the family member 24 hours a day during hospitalization, engaging in conversation and dialogue, and memorizing images and language. Geriatricians treat the syndrome; however, work must be done to prevent this syndrome. At the same time, establishing a dialogue between doctor, patient and family will develop strategies to avoid this syndrome. The persistence of delirium is mainly due to the poor family support network and adherence to the indications made by the

geriatric team, which is why the team must work on limitations to avoid the progression of delirium and it is one of the items: family, work must be done to improve the patient's environment.

After three months, a permanent lesion in the blood-brain barrier has been observed and, in turn, the incidence of DPO in adult patients aged 65 years and over undergoing surgery under balanced general anesthesia reported in the present study, is within the reported range. in international research. It has been observed that DPO is associated with different risk factors such as: body mass index, hypotension, albumin levels, blood transfusions, alcohol consumption, elevated blood glucose levels, duration of surgery, among others.

Currently, in this study carried out in adults aged 70 years and over, undergoing surgery under balanced general anesthesia, an incidence of POD of 44% was found, with no significant differences by age and sex groups. On the other hand, some studies have found different percentages than those found in the present study. An incidence of 42.0% has been reported in 283 patients who underwent hip arthroplasty in people over 70 years of age. Likewise, in a study between 1966 and 1992, an incidence of DPO of 36.8% was found, a figure similar to that found in the present study. Finally, in older adults undergoing general surgery, an incidence of 13.2% lower than that found in the present study was reported. This difference in the incidence of DPO could be due to different factors such as a longer hospital stay, a greater risk of complications, and a reduction in functionality and cognitive status.

In this study, patients with POD presented a longer time and duration of surgery, a greater volume of bleeding, as well as a trend of higher intraoperative serum glucose levels, a higher frequency of intraoperative hypotension and bradycardia, greater use and frequency of use of Foley catheter and in this case of intraoperative transfusions. But already in the logistic regression analysis, the variables associated with DPO were the duration of surgery (OR = 1.04) and elevated blood glucose levels (OR = 1.02). In a study in patients older than 65 years in China, it was found that the variables associated with DPO were age (OR = 1.10, $p < 0.001$), blood glucose (OR = 1.22, $p = 0.001$) and duration of surgery. (RM = 1.01, $p = 0.026$), the association was similar to that found in the present study.

It has been observed that DPO is associated with different risk factors such as: body mass index, hypotension, albumin levels, blood transfusions, alcohol consumption, elevated blood glucose levels, duration of surgery, among others.

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ANEXO

Table 1.- Risk factors in the development of postoperative delirium

Values	Odds ratio (95%)	value of p
Age	0.97 (IC 95% 0.86-1.09)	0.646
Minutes of Surgery	1.04 (IC 95% 1.01-1.06)	0.004
Glucose between Surgery	1.02 (IC 95% 1.00-1.04)	0.049
Blood Transfusion	2.57 (IC 95% 0.17-36.9)	0.487

Table 2.-The incidence of Postoperative Delirium in adult patients aged 70 years and over undergoing surgery under balanced general anesthesia reported in this study is within the range reported in international research.

Percentage	Age		
10	22.7		
20	36.4		
30	40.9		
40	44		
Values	No DPO: 28	With DPO: 22	Vlaue of p
Age	69.6±7.2	72.2±6.9	0.205
Time of Surgery (value: minutes)	89.6±25.6	135.5±41.2	0
Blood volume (value: ml)	136.4±139.1	295.4±192.7	0.001
Glucose measure in Surgery	135.5±25.9	162.9±44.2	0.007
Preoperative hematocrit (%)	43.4±3.7	43.3±2.9	0.576
Preoperative hemoglobin (g/dl)	12.3±0.9	12.4±0.8	0.668
Glucose (%)			
140 mg/dl	17 (60.7)	5(22.7)	0.007
140 mg/dl	11 (39.3)	17 (77.3)	
Intraoperative hypotension			
Systolic<90 mmHg, Diastolic <50 mmHg			
Yes	13 (46.4)	19 (86.4)	
No	15 (53.6)	3 (13.6)	0.003
Intraoperative hypertension			
Systolic<140 mmHg, Diastolic <90 mmHg			
Yes	9 (32.1)	13 (59.1)	
No	19 (67.9)	9 (40.9)	0.057
Intraoperative bradycardia			

<50 beats per minute			
Yes	12 (42.9)	19 (86.4)	
No	16 (57.1)	3 (13.6)	0.02
Intraoperative tachycardia			
>100 beats per minute			
Yes	6 (21.4)	4 (18.2)	
No	22 (78.6)	18 (81.8)	0.776
Use of foley catheter			
Yes	1 (3.6)	6 (27.3)	
No	27 (96.4)	16 (72.7)	0.017
Preoperative blood transfusion			
Yes	1 (3.57)	7 (31.8)	
No	27 (96.4)	15 (68.2)	0.007