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# Characterization of the Postoperative Cognitive Sphere of Octagenary Patients Under Regional or General Anesthesia

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**Abstract:** Postoperative delirium is defined as an acute alteration of consciousness with signs of inattention, disorientation and memory disturbances that fluctuate over time. More and more octogenarian patients cared for in the Anesthesiology and Resuscitation service of the Morón Hospital are undergoing surgical interventions of various kinds, having to use various anesthetic techniques depending on the intervention to be performed. The objective was to characterize the postoperative cognitive sphere of octogenarian patients under regional or general anesthesia treated at the Anesthesiology and Resuscitation service of the Morón Provincial General Teaching Hospital. A prospective longitudinal descriptive observational study was carried out. The study universe was made up of 55 octogenarian patients treated in the Surgical Unit; the sample was selected through an intentional non-probabilistic sampling, being made up of 30 octogenarian patients undergoing hip fracture surgery, which represents 54.5%. It showed that: Both anesthetic techniques showed similarities in terms of the modification of the cognitive state of octogenarian patients, but general orotracheal anesthesia had more influence in the cognitive sphere, especially due to anterograde amnesia caused by benzodiazepines. Hyperaxic delirium was the most common in both groups. He reached the conclusions: There is no difference as to which anesthetic technique has the most influence on the postoperative cognitive sphere of the octogenarian patient.

**Keywords:** Postoperative Cognitive Dysfunction, Hip Fracture, Elderly

## 1. Introduction

Postoperative delirium is defined as an acute disturbance of consciousness with signs of inattention, disorientation and memory disturbances that fluctuate over time [1]. It is independently associated with an increase in mortality, hospital stay, functional decline and general costs of the institutions; It usually presents between the first and third postoperative days and has an incidence of 5 to 15% and in some groups, such as hip fractures, the incidence is as high as 33 to 62% [2]. It has not been possible to establish an exact cause of this syndrome and it seems that it is the influence of several combined factors such as the use of benzodiazepines, opioids or corticosteroids, the level of education, the type of surgery, the depth of anesthesia, comorbidities such as end-stage kidney disease or diabetes, among other factors, determine the presence of this complication.

Postoperative cognitive deficit (POCD) is a term used to describe a syndrome characterized by disturbances of consciousness, attention, perception, thought, memory, behavior and emotions that occurs after surgery [3]; This complication appears within days or weeks, appearing early in the first 7 days postoperatively and late in the first 3 months, the incidence is variable, being very important in cardiac surgery with a frequency that is between 30 and 80% and in major non-cardiac surgery 25% in early presentation and 9.9% in late presentation. The causes of postoperative cognitive deficit are not clear and it seems that a combination of factors is responsible for the appearance of this syndrome. For the identification of these two syndromes there are various tests

that can be applied easily and quickly in the consultation and in the postoperative period; Unfortunately, the personnel in charge of the patients is inadequately prepared for this evaluation, with reports of the frequency of non-detection of delirium of 33 to 66% [4, 5]. The most common signs of POCD concern memory, attention, concentration, speed of mental and motor responses, and learning difficulties.

In the first 3 weeks, POCD affects about 30% of patients after major surgery and 7% after minor surgery. POCD improves between the third week and the sixth month. Beyond the sixth month, the results of the psychometric tests are usually identical to those obtained before the intervention. In most studies evaluating POCD, the mean age of the participants assessed has been approximately 60 years, and many studies specifically select participants from an "older" age group. This is due, in part, to beliefs that cognitive dysfunction will be much more likely in "older people." [6]

The geriatric population is the fastest growing age group in developed countries. Life expectancy has increased dramatically due in large part to advances in medical technology. In the US in 1990, it comprised 13% of the population and it was expected to be 18% in 2020 and 25% in 2050. In this period, the number of people over 85 years of age will more than double. [7]

In the hospital units, an aging population of their beneficiaries has been identified; there is an increase in the proportion of hospitalized elderly: 27% of people over 65 and under 75 are hospitalized, and 45% of those over 75 years are hospitalized at least once a year [8]. The fact of the institutional admission of an old man implies two situations that are observed frequently; one of them corresponds to the so-called therapeutic ferocity and the other to the so-called therapeutic nihilism.

In Cuba, given the continuous aging of the population, which is among the 3 countries of the continent with the most aging, with 14.5% in 2015. The provinces that present a higher rate of population aging in the country are Villa Clara and Havana with 17.4% and 17.1% respectively and the Plaza de la Revolution municipalities, with 22%; October 10, with 21% of older adults.

In Ciego de Ávila, in 2010, a similar study was carried out in patients undergoing hip surgery, where the implication of intrathecal neuroaxial anesthesia in the cognitive sphere of patients was observed. Subsequently, at the XI Congress of the Cuban Society of Anesthesiology and Resuscitation (SCAR), held in October 2017, another study was presented on the use of the Pfeiffer Test for the diagnosis of COPD.

In anesthesiology services, we continue to see a growing number of elderly who require anesthetic techniques for surgery and / or diagnostic procedures. The incidence of peri-anesthetic complications is higher due to functional changes and the high incidence of accompanying diseases in this group of patients. The quality of anesthesiological care for the elderly is highly variable and has tended to improve dramatically in recent years. It is important to learn the vital differences of the elderly to offer them up-to-date care that guarantees a favorable evolution. The best anesthesia for the elderly is not the one that is best known, it is not with the most experienced technique; the best anesthesia is the one that offers the best perioperative conditions. [11]

Given the increase in the life expectancy of the population, more and more octogenarian patients treated in the Anesthesiology and Resuscitation service of the Morón Hospital are those who undergo surgical interventions of various kinds, having to use various anesthetic techniques according to The intervention to be carried out, in addition, it is not specified exactly how these techniques affect the cognitive sphere of these patients.

Faced with this problem, the following scientific problem is required: What characterizes the postoperative cognitive sphere of octogenarian patients under regional or general anesthesia?

Therefore, we set ourselves as a general objective: To characterize the postoperative cognitive sphere of octogenarian patients under regional or general anesthesia treated in the Anesthesiology and Resuscitation service of the Morón Provincial General Teaching Hospital.

## 2. Method

A prospective longitudinal descriptive observational study was carried out to characterize the postoperative cognitive sphere of octogenarian patients under regional or general anesthesia treated in the Anesthesiology and Resuscitation service of the General Provincial Teaching Hospital of Morón, in the period from January 2018 to January 2020.

The study universe consisted of 55 octogenarian patients treated in the Surgical Unit of the Hospital de Morón, the sample was selected through a non-probabilistic sampling of an intentional type, being made up of 30 octogenarian patients undergoing hip fracture surgery, representing 54, 5% and that responded to the inclusion and exclusion criteria.

Inclusion criteria: All patients older than 80 years undergoing hip fracture surgery with ASA I or ASA II, physical status, according to the American Society of Anesthesiology

Exclusion criteria: Patients with decompensated chronic diseases, acute processes and some mental deterioration.

Exit criteria: Patients who suffered decompensation from their underlying disease during the intraoperative period or suffered from cardiorespiratory arrest.

We define the preoperative period as that from when the patient arrives at the Surgical Unit and the postoperative period as the first 72 hours after surgery.

*Main dimensions and indicators:*

1. Cognitive state of the patient:
2. Temporal orientation
3. Spatial orientation
4. Memory
5. Attention and calculation
6. Deferred memory
7. Language and psychomotor skills

Each indicator will be evaluated using the Minimental Folstein Test. (Appendix)

# 3. Results

***Table 1.*** *Distribution of octogenarian patients undergoing hip surgery, in the Surgical Unit of the Hospital Provincial de Morón, in the period from January 2018 to January 2020, according to the patient's cognitive status according to temporal orientation in the pre and pre-and postoperative.*

| anesthetic technique | Temporal orientation | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Preoperative | | | | | | Postoperative | | | | | |
| | N | % | D | % | B | % | N | % | D | % | B | % |
| neuraxial anesthesia | 10 | 52,6 | 8 | 42,1 | 1 | 5,3 | 9 | 47,4 | 9 | 47,4 | 1 | 5,3 |
| orotracheal general anesthesia (OGA) | 8 | 72,7 | 2 | 18,2 | 1 | 9,1 | 5 | 45,5 | 4 | 36,4 | 2 | 18,2 |
| Total: | 18 | 60,0 | 10 | 33,3 | 2 | 6,7 | 14 | 46,6 | 13 | 43,3 | 3 | 10,0 |

Source: Folstein Minimental Test.

Table 1 shows that the patients during their preoperative period did not present significant alterations in their temporal orientation, while in the postoperative period the patients who received general orotracheal anesthesia presented not so significant differences with respect to those who received spinal anesthesia.

***Table 2.*** *Cognitive state of the patient according to spatial orientation in the pre and postoperative room.*

| anesthetic technique | Spatial Orientation | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Preoperative | | | | | | Postoperative | | | | | |
| | N | % | D | % | B | % | N | % | D | % | B | % |
| neuraxial anesthesia | 9 | 47,4 | 9 | 47,4 | 1 | 5,3 | 7 | 36,8 | 8 | 42,1 | 4 | 21,0 |
| orotracheal general anesthesia | 8 | 72,7 | 2 | 18,2 | 1 | 9,1 | 4 | 36,4 | 4 | 36,4 | 3 | 27,3 |
| Total: | 17 | 56,7 | 11 | 36,7 | 2 | 6,7 | 11 | 36,6 | 12 | 40,0 | 7 | 23,3 |

Source: Folstein Minimental Test.

Table 2 represents the cognitive status of the patient according to spatial orientation in the pre and postoperative room, note how in the postoperative period the two anesthetic techniques presented significant changes with respect to their initial values.

***Table 3.*** *Cognitive state of the patient according to memory in the pre and postoperative room.*

| anesthetic technique | Memory | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Preoperative | | | | | | Postoperative | | | | | |
| | N | % | D | % | B | % | N | % | D | % | B | % |
| neuraxial anesthesia | 10 | 56,6 | 7 | 36,8 | 2 | 10,5 | 8 | 42,1 | 7 | 36,8 | 4 | 21,0 |
| orotracheal general anesthesia | 9 | 81,8 | 1 | 9,1 | 1 | 9,1 | 4 | 36,4 | 3 | 27,3 | 4 | 36,4 |
| Total: | 19 | 63,3 | 8 | 26,7 | 3 | 10,0 | 12 | 40,0 | 10 | 33,3 | 8 | 26,7 |

Source: Folstein Minimental Test.

There were memory-related modifications, increasing the number of patients with poor evaluation

***Table 4.*** *Cognitive state of the patient according to care and calculation in the pre and postoperative room.*

| anesthetic technique | Attention and calculation | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Preoperative | | | | | | Postoperative | | | | | |
| | N | % | D | % | B | % | N | % | D | % | B | % |
| neuraxial anesthesia | 11 | 57,9 | 7 | 36,8 | 1 | 5,3 | 11 | 57,9 | 7 | 36,8 | 1 | 5,3 |
| orotracheal general anesthesia | 9 | 81,8 | 1 | 9,1 | 1 | 9,1 | 8 | 72,7 | 2 | 18,2 | 1 | 9,1 |
| Total: | 20 | 66,7 | 8 | 26,7 | 2 | 6,7 | 19 | 63,3 | 9 | 30,0 | 2 | 6,7 |

Source: Folstein Minimental Test.

In relation to care and calculation, Table 4, there were no differences in both techniques or periods evaluated

***Table 5.*** *Cognitive status of the patient according to deferred memory in the pre and postoperative room.*

| anesthetic technique | Deferred memory | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Preoperative | | | | | | Postoperative | | | | | |
| | N | % | D | % | B | % | N | % | D | % | B | % |
| neuraxial anesthesia | 10 | 56,6 | 7 | 36,8 | 2 | 10,5 | 8 | 42,1 | 7 | 36,8 | 4 | 21,0 |
| orotracheal general anesthesia | 9 | 81,8 | 1 | 9,1 | 1 | 9,1 | 4 | 36,4 | 3 | 27,3 | 4 | 36,4 |
| Total: | 19 | 63,3 | 8 | 26,7 | 3 | 10,0 | 12 | 40,0 | 10 | 33,3 | 8 | 26,7 |

Source: Folstein Minimental Test.

It can be seen in Table 5 that there were no differences between the periods, however, the patients who received GOT anesthesia during the postoperative evaluation had a higher evaluation rated as poor.

***Table 6.*** *Cognitive state of the patient according to language and psychomotor skills in the pre and postoperative room.*

| anesthetic technique | Language and motor skills | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Preoperative | | | | | | Postoperative | | | | | |
| | N | % | D | % | B | % | N | % | D | % | B | % |
| neuraxial anesthesia | 10 | 52,6 | 9 | 47,4 | 0 | 0 | 10 | 52,6 | 9 | 47,4 | 0 | 0 |
| orotracheal general anesthesia | 6 | 54,5 | 4 | 36,4 | 1 | 9,1 | 3 | 27,2 | 7 | 63,6 | 1 | 9,1 |
| Total: | 16 | 53,3 | 13 | 43,3 | 1 | 3,3 | 13 | 43,3 | 16 | 53,3 | 1 | 3,3 |

Source: Folstein Minimental Test.

Table 6 also shows differences in the group that received GOT anesthesia in terms of language and motor skills, in both periods.

# 4. Discussion

In the elderly, there are changes that occur due to the progressive loss of cells. These modifications are highly variable from individual to individual, from organ to organ, but they unerringly result in physical and mental deterioration. The structural and functional changes associated with advanced age imply that the CNS of the elderly has decreased functional reserve, which makes the elderly more susceptible to postoperative cognitive dysfunction (POSD) [11].

Postoperative cognitive dysfunction is characterized by altered consciousness, with hallucinations and loss of spatial notion; In general, patients are lucid in the morning, but these symptoms appear as the day progresses. Of acute installation, the patient is disoriented and agitated. In some, there is a prodromal phase with irritability and attention disorder. There is short and long-term memory impairment. It would represent an alteration of oxidative metabolism and brain neurotransmitters (NT). Consequently, any drug that interferes with the function of NTs or with the supply of substrate for their metabolism could produce delirium. This would explain the stereotypical response to a wide range of noxas. The central cholinergic pathways are involved in the regulation of attention, memory, learning, information processing, and sleep and are highly sensitive to toxic and metabolic damage. Cholinergic pathways are very important for the development of delirium, but serotonin and norepinephrine pathways are also involved [12].

There are several possible reasons for these alterations: in some patients, the etiological factor responsible for delirium such as perioperative hypoxia can lead to structural brain damage, causing permanent cognitive impairment. In others, the insult that triggers the delirium is mild and the delirium would be a marker of decreased brain reserve.

Postoperative cognitive dysfunction presents as memory and concentration disturbances and can persist weeks or months after surgery. It resembles dementia, but in most cases the deficits, are not as severe and most of the studies that exist have been done in patients undergoing cardiac and orthopedic surgery. [13].

In various studies on the incidence of postoperative neurological complications in older patients, no differences have been found between the percentage of presentation and the use of regional or general anesthesia, even some studies show no differences in cardiovascular complications, use of the intensive care unit or general costs of hospitalization in older patients with the use of one or another type of anesthesia [14, 15]. Bryson, in a meta-analysis of 18 randomized studies on the topic of delirium and cognitive dysfunction, did not find significant differences between the uses of regional or general anesthesia, emphasizing the difficulty in preventing these two events due to the difficulty of managing some of the risk factors related to patients [16]. In White's observational study of 65,535 patients, no difference was found in the mortality of patients undergoing surgery for correction of hip fracture with regional or general anesthesia, finding that the only difference in the outcome was the use of cemented prostheses, which increased mortality in the first 24h. [17]

Pay attention to the patient's fears, communicate to the relatives that the delirium is transitory because they may think that the patient has suddenly become insane. Physical restraint is inhumane and increases agitation and morbidity; exclusive personnel should be assigned to this patient.

These are apparently minor problems, but they cause great discomfort to patients. Some are unable to keep track of their accounts, because they forget the arithmetic. Patients with very high memory or organizational needs, such as doctors or lawyers, can be permanently disabled if they lose these powers to a significant degree. [18].

The patient with mild cognitive impairment does not retain more than he did the first time (for example, ten words), despite the other opportunities, and sometime later he remembers even fewer words (for example, eight). Memory is evaluated with word lists, more than once. DCPO refers to the impairment of intellectual functions, which occurs as an impairment of memory or concentration. DCPO manifests itself very subtly; in fact, in the eyes of a stranger the person appears normal. [19].

According to various authors, older patients have a lower capacity to regulate homeostasis in the face of stress and more collateral effects due to the effect of drugs. The risk of delirium increases with the complexity of the surgical procedure. However, it is not clear whether this is caused by the poor physical condition of patients requiring major

surgery, or by the metabolic stress generated by the surgery itself. The incidence of age-related cognitive decline is very common. Approximately 5% of those over 65 years of age suffer from dementia, generally a consequence of severe disease, while minor cognitive alterations are observed in 2/3 of the "healthy" elderly. These changes can be divided into secondary to diseases or as primitive cognitive decline, but the line that separates them is very subtle. Manifestations include:

1) Slowdown in reaction time, which is due to decreased sensory sensitivity (for example, deafness) as well as central changes such as slowing down in central information processing.
2) Deterioration of "liquid" intelligence, for example the ability to evaluate and respond to new events. However, those functions that depend on "crystallized" intelligence (eg accumulation of knowledge) remain relatively stable.
3) Decrease in short-term memory: the ability to store recent information is compromised, as well as the acquisition of new data. [20].

# 5. Conclusions

There were similarities in terms of the modification of the cognitive state of octogenarian patients, but general orotracheal anesthesia had a greater influence on the cognitive sphere, especially due to anterograde amnesia caused by benzodiazepines.

# Appendix: Minimental Folstein Test

***Table 7.*** *Time orientation analysis.*

| **TEMPORARY ORIENTATION** | | |
|---|---|---|
| **TO EVALUATE** | **PREOPERAT** | **POSTOPERAT** |
| What year are we in | | |
| What season of the year are we in | | |
| In what month | | |
| What day of the month | | |
| What day of the week | | |

Normal: 5 points Deteriorated: 3 points Bad: 2 or less

***Table 8.*** *Analysis of spatial orientation.*

| **SPATIAL ORIENTATION** | | |
|---|---|---|
| **TO EVALUATE** | **PREOPERAT** | **POSTOPERAT** |
| What country are we in | | |
| What city | | |
| In which hospital | | |
| In which part of the hospital | | |

Normal: 4 points Deteriorated: 3 points *Bad: 2 or less*

***Table 9.*** *Memory analysis.*

| **MEMORY** | | |
|---|---|---|
| **TO EVALUATE** | **PREOPERAT** | **POSTOPERAT** |
| Repeat these words (I'll ask you again) Apple, table, city | | |

Normal: 3 points Deteriorated: 2 points Bad: 1 or less

***Table 10.*** *Attention analysis and calculation.*

| **ATTENTION AND CALCULATION** | | |
|---|---|---|
| **TO EVALUATE** | **PREOPERAT** | **POSTOPERAT** |
| Count down one at a time until I stop it starting with: 90, 89,88,87,86,85 | | |

Normal: 5 points Deteriorated: 3 points Bad: 2 or less

***Table 11.*** *Analysis of deferred memory.*

| **DEFERRED MEMORY** | | |
|---|---|---|
| **TO EVALUATE** | **PREOPERAT** | **POSTOPERAT** |
| Repeat the words that I requested you to retain. (apple, table, city) | | |

Normal: 3 points Deteriorated: 2 points Bad: 1 or less

***Table 12.*** *Language analysis and psychomotor skills.*

| **LANGUAGE AND PSYCHOMOTRICITY** | | |
|---|---|---|
| **TO EVALUATE** | **PREOPERAT** | **POSTOPERAT** |
| Draw this geometric figure (square) | | |
| Show your watch - what is this? | | |
| Show a pencil - what is this? | | |
| Close your eyes | | |
| Repeat "neither yes, nor no, nor but" | | |
| Do what you say: | | |
| a) Pick up the paper with your right hand | | |
| b) Fold the paper with your hands | | |
| c) Throw the paper on the floor | | |

Normal: 8 points Deteriorated: 5 points Bad: 4 or less

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