

# GREATER RISK OF POSTOPERATIVE DELIRIUM IS ASSOCIATED WITH ADVANCED AGE, ANEMIA, AND LOW COGNITIVE RESERVE

## Maior risco de delirium no pós-operatório está associado à idade avançada, anemia e baixa reserva cognitiva

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### ABSTRACT

**INTRODUCTION:** Delirium is an acute change in cognition and attention, common in the postoperative period in older patients, associated with increased costs and longer hospital stay. **OBJECTIVE:** To evaluate the frequency, risk factors, and influence of postoperative delirium in older patients submitted to elective noncardiac surgery. **METHOD:** This was a cross-sectional, observational study of older adults (65 years or older) hospitalized for elective noncardiac surgery. During the immediate preoperative period (24 hours), risk factors such as age, sex, cognition (MiniCog), functional status (Katz and Timed Up and Go), medications, and clinical aspects were evaluated. Delirium, in the immediate postoperative period (up to 72 hours), was evaluated using the Confusion Assessment Method (CAM). **RESULTS:** A total of 83 patients were included in the study. Of these, 44.6% (n = 37) had undergone orthopedic surgery, 42.16% (n = 35), general surgery, and 13.3% (n = 11), urological surgery. Most participants were men (53%), with a mean age of 73 (65–94) years. Overall, 9.6% (n = 8) had postoperative delirium: 6% of the hyperactive subtype (n = 5), 2.4% of the hypoactive subtype (n = 2), and 1.2% of the mixed subtype (n = 1). These patients were older (p = 0.02), had greater cognitive decline (p = 0.01), anemia (p = 0.04), and prolonged hospital stay (p = 0.001). **CONCLUSION:** Postoperative delirium was more commonly observed in the older old with cognitive decline and anemia, with an impact on hospital length of stay, highlighting the importance of a more comprehensive preventive evaluation in the preoperative period. **KEYWORDS:** delirium; postoperative period; health of the elderly.

### RESUMO

**INTRODUÇÃO:** Delirium é uma mudança aguda na cognição e atenção, comum no período pós-operatório em pessoas idosas, associada ao aumento de custos e à permanência hospitalar. **OBJETIVO:** Avaliar frequência, fatores de risco e influência no período de permanência hospitalar de delirium pós-operatório em pacientes idosos submetidos a cirurgias não cardíacas eletivas. **MÉTODO:** Estudo do tipo transversal, observacional, de pessoas idosas (65 anos de idade ou mais), internadas para realização de cirurgia eletiva não cardíaca. Durante o período pré-operatório imediato (24 horas) foram avaliados os fatores de risco: idade, gênero, cognição (MiniCog), funcionalidade (Katz e *time up and go*), fármacos e aspectos clínicos. O delirium, no pós-operatório imediato (até 72 horas), foi avaliado através do *Confusion Assesment Method* (CAM). **RESULTADOS:** Oitenta e três pacientes foram incluídos na pesquisa, sendo 44,6% (n = 37) de cirurgia ortopédica, 42,16% (n = 35) de cirurgia geral e 13,3% (n = 11) de cirurgia urológica. Predominou o sexo masculino (53%), com idade média de 73 anos (65 a 94) anos. Na amostra de pacientes, 9,6% (n = 8) apresentaram delirium pós-operatório: 6% do tipo hiperativo (n = 5), 2,4% do tipo hipoativo (n = 2) e 1,2% do tipo misto (n = 1). Eram mais idosos (p = 0,02), com maior declínio cognitivo (p = 0,01), anemia (p = 0,04) e prolongamento na permanência hospitalar (p = 0,001). **CONCLUSÃO:** O delirium pós-operatório foi observado com maior frequência nos pacientes mais idosos, portadores de declínio cognitivo e anemia, com influência no período de hospitalização, demonstrando a importância de uma avaliação preventiva mais abrangente no período pré-operatório. **PALAVRAS-CHAVE:** delirium; período pós-operatório; saúde do idoso.

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## INTRODUCTION

Delirium is a neurobehavioral syndrome caused by transient impairment of brain activity, characterized by an acute onset with fluctuating levels of awareness and attention as well as changes in cognitive functions, and which is invariably secondary to systemic disorders.<sup>1</sup> Several predictive models have been developed to explain its occurrence in the postoperative period.<sup>2</sup>

Postoperative delirium is a common complication of surgical procedures in older patients, occurring in 5 to 50% of cases in the postoperative period,<sup>3-5</sup> with an estimated annual cost of 150 billion dollars in the United States.<sup>6</sup> There are several risk factors for the development of postoperative delirium in older patients, including cognitive and functional decline, immobility, visual and hearing impairments, and associated clinical conditions (renal failure, anemia, dehydration, infection, electrolyte disturbance, polypharmacy, high-risk medications, and inadequate pain control).<sup>5</sup>

The objective of this study was to investigate the frequency and factors associated with delirium in the immediate postoperative period of older patients submitted to elective non-cardiac surgery, conducted in a general university hospital, in addition to its impact on length of hospital stay.

## METHOD

This was a cross-sectional, observational study of older adults (65 years of age or older) hospitalized for elective non-cardiac surgery at Hospital Santa Casa de Misericórdia, in the municipality of Vitória, state of Espírito Santo, southeastern Brazil. During the preoperative period (24 hours), the following risk factors were analyzed (independent variables): age (in years), sex (male/female), and cognition. Cognition was assessed with the MiniCog, which is a rapid, 5-point test (recall is evaluated using a list of 3 words that the patient should be able to remember after drawing a clock which, in turn, functions as a distractor). One point is given for each word recalled, and 2 points for a correct clock drawing, for a total score of 5. A total score of 3 to 5 is considered normal and of 0 to 2, abnormal, i.e., patients are considered to have cognitive decline.<sup>6</sup> Functional dependence for activities of daily living was evaluated using the KATZ scale, which assesses 6 items related to self-care: bathing, dressing, toileting, transfer, urinary or fecal continence, and feeding (0: independent in all 6 functions; 1: independent in 5 functions and dependent in 1 function; 2: independent in 4 functions and dependent in 2 functions; 3: independent in 3 functions and dependent in 3 functions; 4: independent in 2 functions and dependent in 4 functions; 5: independent

in 1 function and dependent in 5 functions; 6: dependent in all 6 functions).<sup>7</sup> Scores of 0-1 were regarded as functional independence; 3-5, medium dependence; and 5-6, dependence.<sup>8</sup> Functional status was evaluated by the Timed Up and Go test<sup>9</sup> (patients are required to stand up from a chair and walk a distance of 3 meters; those completing the task in less than 20 seconds are rated as 'able', and in more than 20 seconds as 'unable'), use of medications (benzodiazepines, anticholinergics, antihistamines, antipsychotics), and presence of anemia (hemoglobin  $\leq$  13 g/dL for men and  $\leq$  12 g/dL for women), hypertension (blood pressure  $\geq$  140/90 mmHg or use of antihypertensives), and diabetes mellitus (blood glucose  $\geq$  126 mEq/L or oral antidiabetic use).<sup>10-12</sup>

Delirium (dependent variable) was evaluated in the immediate postoperative period (up to 72 hours) using the Confusion Assessment Method (CAM), a method with high sensitivity (94%) and specificity (98%),<sup>5</sup> which has been validated in Brazil to detect the presence or absence of delirium.<sup>13</sup> For the diagnosis of delirium, the presence of A and B items plus C and/or D items was considered:

- A: acute onset and floating course;
- B: inattention;
- C: disorganized thinking;
- D: altered level of consciousness.

The study was initiated in the preoperative period (up to 24 hours), after written informed consent was provided by the participant, and conducted from January to July 2017.

Descriptive statistics, Pearson's correlation coefficient,  $\chi^2$  test, and Student's *t* test were used for independent samples. Data were analyzed with SPSS, version 25.0, licensed for the Escola Superior de Ciências da Santa Casa de Misericórdia de Vitória (EMESCAM). The study was approved by the Research Ethics Committee at EMESCAM on October 7, 2015, under approval certificate number CAAE 49917415.5.0000.5065.

## RESULTS

A total of 83 patients were included in the study. Of these, 44.6% ( $n = 37$ ) had undergone orthopedic surgery, 42.16% ( $n = 35$ ), general surgery, and 13.3% ( $n = 11$ ), urological surgery. Overall, 53% ( $n = 44$ ) were men and mean age was 73 (65-94) years. Overall, 91.6% were independent for activities of daily living, 64.8% ( $n = 46$ ) had mild anemia, and 31.3% ( $n = 26$ ) had cognitive decline. Also, 9.6% ( $n = 8$ ) had delirium in the immediate postoperative period, with a mean duration of symptoms of 3.7 days (1 to 8 days): 6% of the hyperactive type ( $n = 5$ ), 2.4% of the hypoactive type ( $n = 2$ ), and 1.2% of the mixed type ( $n = 1$ ). Patients who had

delirium were significantly older ( $p = 0.02$ ), had cognitive decline ( $p = 0.01$ ), anemia ( $p = 0.02$ ), and a longer length of hospital stay ( $p = 0.001$ ), as shown in Table 1. Postoperative delirium positively correlated with cognitive decline ( $r = 0.30$ ;  $p = 0.005$ ) and anemia ( $r = 0.26$ ;  $p = 0.02$ ).

## DISCUSSION

Of the patients hospitalized for elective noncardiac surgery, 9.6% had delirium in the immediate postoperative period; these patients were older and had a longer hospital stay. Raats et al. observed a higher frequency of postoperative delirium after elective colon surgery (18%).<sup>14</sup> Gleason et al., in a larger sample of older patients submitted to elective surgical procedures, with a profile similar to that of the present sample, observed a frequency of delirium of 23.9%, with an increase in the length of hospital stay by 5 days on average.<sup>15</sup>

The present study found a lower frequency of postoperative delirium than that of previous studies,<sup>16</sup> which is probably related to the small sample size and non-inclusion of emergency surgery in the study. However, we used CAM

for diagnosis, a method used for clinical screening in 75% of studies, as demonstrated in a recent meta-analysis.<sup>17</sup>

In the immediate preoperative period, we performed a comprehensive geriatric evaluation, adapted from the American College of Surgeons National Surgical Quality Improvement Program (ACS NSQIP) and the American Geriatrics Society (AGS) guidelines,<sup>18</sup> with several domains evaluated. Patients who had postoperative delirium were older, had cognitive impairment, and were anemic. We found no association with the remaining independent variables under study.

Several studies have demonstrated cognitive decline as an important risk factor for delirium.<sup>16</sup> In the present study, we used the MiniCog test,<sup>6</sup> as recommended by the ACS NSQIP and AGS.<sup>18</sup> Among patients who developed postoperative delirium, 75% had abnormal scores (0 to 2), showing an important correlation between the two variables ( $r = 0.308$ ;  $p = 0.005$ ). Another factor, observed in 100% of the patients who had postoperative delirium, was the presence of anemia in the preoperative evaluation, with a positive correlation ( $r = 0.263$ ,  $p = 0.02$ ). Raats et al., in a sample of 232 elective surgical procedures, found that 74% of

**Table 1** Independent variables of patients in the postoperative period.

Independent variables (preoperative)	Without delirium (n = 75)	With delirium (n = 8)	p
Age (years)* (mean ± standard deviation)	72 ± 6	78 ± 9	0.02
Body mass index* (mean ± standard deviation)	25 ± 5	23 ± 6	0.34
Sex (% women/% men)	45.3/54.7	62.5/37.5	0.34
MiniCog (0 to 2 points)# (cognitive decline) n (%)	20 (26.7)	6 (75)	0.01
Dependence for ADLs# (KATZ > 5 functions) n (%)	6 (8)	1 (12.5)	0.55
Functional status (UNABLE: Timed Up and Go)# n (%)	13 (21)	4 (50)	0.09
Anemia# n (%)	38 (60.3)	8 (100)	0.02
Hemoglobin (g/dL)* (mean ± standard deviation)	11 ± 1.8	10 ± 2.4	0.04
Previous use of benzodiazepines# n (%)	5 (62.5)	3 (37.5)	0.41
Polypharmacy # n (%)	4 (50)	4 (50)	0.22

\*Student's t test for independent samples for continuous variables; # $\chi^2$  test (dichotomous variables); ADLs: activities of daily living.

patients with delirium had anemia in the preoperative evaluation.<sup>14</sup> Preoperative anemia probably reduces tissue perfusion, with reduction of oxygen transport, acting as a risk factor for postoperative delirium. Because of this factor, it is recommended that anemia be detected and corrected in the preoperative period of elective surgery, preventing the occurrence of postoperative delirium.<sup>19</sup> Patients with delirium had a higher frequency of functional dependence and greater functional impairment than those without delirium, but with no significant difference between them.

The limitations of this study include the absence of cardiac evaluation, complementary tests performed up to 3 months before the procedure, and the difficulty of conducting a

comprehensive evaluation in some patients, who were admitted just before surgery. Also, the small sample size, the elective surgical procedures (orthopedic, general, and urological surgery), and other important variables that were not analyzed, such as electrolytes, use of anticholinergic medications, and visual and hearing impairments, can be seen as limitations of this study.

In conclusion, presence of postoperative delirium was more commonly observed in the older old with cognitive impairment and anemia. Patients without delirium were hospitalized longer than those without delirium, highlighting the importance of a comprehensive evaluation to prevent the presence of delirium, with increased postoperative morbidity.

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