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ORIGINAL RESEARCH

Functional capacity as a predictor of postoperative delirium in transurethral resection of prostate patients in Northeast Brazil

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Introduction: Postoperative delirium (POD) is a common disorder and its frequency varies from 15% to 25% after major elective surgery. There are few data on the incidence of POD in Brazil. Here, we sought to assess the incidence of POD following transurethral resection of the prostate (TURP) and to examine precipitating and predisposing factors associated.

Method: We performed a prospective observational study of elderly male patients undergoing TURP (N=55) in Northeast Brazil. Information on demographic, medical, cognitive and functional characteristics were collected. The participants were followed until hospital discharge. POD was diagnosed by the Confusion Assessment Method.

Results: A total of three participants (5.45%) were identified with POD. Episodes of delirium lasted 3±1 days. The study sample consisted of a healthy population. Patients with POD had longer hospital stay and more precipitating factors. The POD group showed statistically significant lower Barthel index score ($p<0.001$) and higher Pfeffer's Functional Activities Questionnaire scores ($p<0.01$).

Conclusion: Loss of functional capacity was associated with POD in a healthy population of elderly patients undergoing TURP.

Keywords: delirium, transurethral resection of prostate, neurocognitive disorders, risk factors, activities of daily living

Introduction

Postoperative delirium (POD) is associated with a significant increase in morbidity and mortality, institutionalization, longer hospital stay and higher health care costs.[1] There are scarce data on the incidence of delirium in Brazil.[2] A study conducted in Brazil found a frequency of POD of 18.8% in 680 multimorbid patients undergoing emergency and high-risk surgery, excluding cardiac and neurological surgical procedures.[3]

The occurrence of delirium depends on the type of surgical procedure and patient health characteristics. Few studies have investigated POD after minor surgery. The risk of POD after transurethral resection of the prostate (TURP) ranged from 4.6% to 21.23% in different studies from China.[4,5]

This study aimed to assess the incidence of POD following TURP and to examine precipitating and predisposing factors associated with elderly patients admitted to a general hospital in a Northeast city of Brazil.

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Methods

Study design and population

We conducted a prospective observational study in a single medical center from November 2016 to November 2017. The study was carried out at Hospital Geral Dr. César Cals, a tertiary academic hospital in Northeast Brazil, which is one of the poorest regions in the country. The inclusion criteria included patients 60 years of age or older who were admitted to the hospital for TURP surgery. The exclusion criteria were preoperative delirium and history of acute neurological disorder (stroke, traumatic brain injury) in the past 3 months.

Study protocol

We carried out a careful clinical evaluation of patients with administration of preoperative assessment scales. We evaluated the participants using a guided interview for geriatric assessment as part of the anamnesis and a simplified physical examination. We administered a standardized questionnaire to collect information on demographic and clinical variables (age, marital status, years of schooling, Charlson Comorbidity Index (CCI),[6] number of medications used and smoking and alcohol consumption), and collected information regarding length of hospital stay, anthropometric measurements and laboratory test results (blood counts, creatinine and sodium).

To delirium diagnosis,[7] we applied the Diagnostic and Statistical Manual of Mental Disorders criteria[8] and the Confusion Assessment Method (CAM).[7] The Mini-Mental State Examination (MMSE)[9] and the Informant Questionnaire on Cognitive Decline in the Elderly (IQCODE)[10] were used for cognitive evaluation. Functional capacity was assessed using the Barthel index (BI)[11] for activities of daily living (ADL) and Pfeffer's Functional Activities Questionnaire (FAQ)[12] for instrumental activities of daily living (IADL). The American Society of Anesthesiologists (ASA) classification was used for risk assessment of preoperative patients.

Surgical and postsurgical assessment

We collected intraoperative information including type of anesthesia and hemodynamic status of the patient during the surgical procedure and results of laboratory tests performed during the surgery, when requested by the surgeon, including hemoglobin, creatinine and sodium. After surgery, we administered the CAM on a daily basis to identify POD. The participants were asked to record their levels of pain at rest preoperatively and postoperatively. We measured pain intensity using a Likert scale (0–10) and assessed precipitating factors of delirium up to hospital discharge.

Statistical analyses

All statistical analyses were performed using the statistical package SPSS 22® for Windows (Version 22, SPSS, Chicago, IL, USA). The presence of a normal distribution of data was determined by the Kolmogorov–Smirnov test. For normally distributed variables with homogeneity of variance, a two-tailed Student's *t*-test was performed. For variables that did not meet the homogeneity of variance requirement, the nonparametric Mann–Whitney U-test was used. Categorical variables were analyzed by Fisher's exact test. The null hypothesis was rejected in every statistical testing when $p<0.05$ for type I error.

Ethical issues

The institution of Universidade de Fortaleza – UNIFOR ethics committee approved the study (approval number 1,562,383). All participants signed an informed consent. All procedures performed in studies involving human participants were in accordance with the 1964 Declaration of Helsinki and its later amendments or comparable ethical standards.

Results

A total of 55 elderly participants (71.80±5.78 years) were included in the study. They had on average 3.06±3.06 years of schooling and 30% were illiterate. CCI scores ranged between 0 (64.80%) and 4 (1.90%). The patients were clinically stable at admission in both groups. There were no significant differences in demographic characteristics and clinical and laboratory parameters between POD and non-POD groups (Table 1). Though not statistically significant, participants in the POD group were older and showed higher CCI scores compared to the non-POD group.

Pain at admission was similar in both groups. The participants used 2.31±2.48 medications. Compared to the POD group, participants in the non-POD group used more psychoactive drugs and more inappropriate medications for the elderly (benzodiazepines, antiparkinsonians and anticholinergics), though this difference was not statistically significant.

All participants underwent spinal anesthesia; 93.50% of them were ASA 2 and only one patient was ASA 3. One patient developed hypotension during surgery and was admitted to the intensive care unit (ICU) and subsequently died.

Table 1 Sociodemographic, clinical, cognitive and functional characteristics and laboratory test results of patients experiencing postoperative delirium (POD) and not experiencing postoperative delirium (non-POD)

	Non-POD (N=52)	POD (N=3)	*p*-value
Age, years[c]	71.46 (5.43)	77.67 (9.71)	0.75[a]
Living with a partner[d]	42 (80.80)	2 (66.70)	0.42[b]
Illiteracy[d]	22 (42.30)	1 (33.30)	0.74[b]
Years of schooling[c]	3.08 (3.10)	2.5 (2.12)	0.50[a]
CCI score[c]	0.55 (0.96)	1.67 (1.15)	0.24[a]
Number of drugs used[c]	2.31 (2.48)	2.5 (3.53)	0.83[a]
Smoking, yes[d]	2 (3.80)	0	0.87[b]
Alcohol use, yes[d]	5 (9.60)	0	0.57[b]
Weight[c]	69.95 (10.8)	76	0.50[a]
Height[c]	1.64 (0.08)	1.6	0.19[a]
Abdominal circumference[c]	100.77 (10.63)	121	0.15[a]
Systolic blood pressure[c]	134.31 (24.55)	130	0.54[a]
Diastolic blood pressure[c]	81.33 (9.25)	70 (14.14)	0.20[a]
Pulse[c]	75.42 (9.97)	80	0.30[a]
Respiratory frequency[c]	16.71 (2.65)	18.5 (0.71)	0.34[a]
Temperature[c]	36 (0.71)	36.05 (0.07)	0.55[a]
Hemoglobin, g/dL[c]	13.28 (1.19)	12.46 (3.43)	0.78[a]
Leukocytes, /µL[c]	10147.50 (14438.04)	15730 (15059.37)	0.47[a]
Lymphocytes, /µL[c]	1776.37 (606.03)	1928 (407.17)	0.50[a]
Creatinine, mg/dL[c]	1.14 (0.38)	1.26 (0.21)	0.05[a]
Sodium, mEq/L[c]	139.11 (2.60)	136.33 (8.14)	0.98[a]
MMSE score[c]	21.23 (4.56)	17	0.32[a]
IQCODE score[c]	3.03 (0.74)	3.46 (0.50)	0.23[a]
BARTHEL index score[c]	94.89 (15.02)	33.3 (25.17)	0.00[a,*]
PFEFFER's FAQ score[c]	2.86 (5.69)	16.33 (12.01)	0.01[a,*]
Hospital stay, days[c]	2.23 (0.49)	6.6 (6.41)	0.00[a,*]
Death[d]	0	1 (33.33)	0.00[a,*]

Notes: [a]Mann–Whitney. [b]Fisher–Exact test. [c]Data shown as mean (SD). [d]Data shown as n (%). *$P<0.05$.
Abbreviations: CCI, Charlson Comorbidity Index; MMSE, Mini-Mental State Examination; IQCODE, Informant Questionnaire on Cognitive Decline in the Elderly; Pfeffer's FAQ, Pfeffer's Functional Activities Questionnaire.

Three patients were identified with POD using the CAM. POD started on day 1 postoperatively in two patients and day 3 postoperatively in one patient. It lasted 3±1 days. One of them died. Table 1 shows cognitive and functional scores for all patients. The POD group showed statistically significant lower BI ($p<0.00$) and higher FAQ scores ($p<0.01$) when compared with the non-POD group. Tables 2 and 3 compare predisposing and precipitating factors for both groups. In the immediate postoperative period, all participants in the POD group were restricted to bed ($p<0.001$). There were no other differences between both groups.

In the following is a detailed description of the patients experiencing POD.

Patient 1 was an 87-year-old male, retired farmer, widowed and illiterate. He had Parkinson's disease (CCI score of 1) and showed an IQCODE score of 4/5, BI of 30/100 and Pfeffer's FAQ score of 17/30. He had low visual acuity and did not use any prior medications, but required a catheter because of urinary retention. He was on a psychoactive drug while in hospital. The patient developed hypotension during surgery and was admitted to the ICU after the surgical procedure and died 2 weeks later.

Patient 2 was an 80-year-old male, farmer, illiterate (1 year of schooling). He had prostate cancer (CCI score of 1) and did not use any prior medications. He had visual impairment, an IQCODE score of 3/5, BI of 60/100 and Pfeffer's FAQ score of 4/30. The episode of delirium started on day 3 postoperatively. He was discharged from the hospital on day 4 after surgery.

Patient 3 was a 78-year-old male, lifeguard and literate (4 years of schooling). He had a CCI score of 3 (stroke, dementia and diabetes). He was on several medications (levodopa/benserazide, promethazine, amlodipine, gliclazide and

Table 2 Predisposing factors in postoperative delirium (POD) and non-postoperative delirium (non-POD) groups

Predisposing factors	Non-POD (N=52), n (%)	POD (N=3), n (%)	*p*-value
Serious illness	7 (13.45)	1 (33.33)	0.42[a]
Comorbidities	3 (5.17)	0	1.00[a]
Depression	4 (7.69)	0	1.00[a]
Visual impairment	28 (53.78)	3 (100)	0.24[a]
Hearing impairment	17 (32.66)	1 (33.33)	1.00[a]
Dehydration	0	0	1.00[a]
Chronic renal failure	0	0	1.00[a]
Liver failure	0	0	1.00[a]
Alcohol use	9 (17.33)	2 (66.77)	0.15[a]
Previous delirium (>3 months)	2 (3.81)	0	1.00[a]
Previous falls	3 (5.84)	0	1.00[a]
Malnutrition	2 (3.82)	0	1.00[a]

Note: [a]Fisher–Exact test.

Table 3 Precipitating factors of delirium in the preoperative period and immediate postoperative period in postoperative delirium (POD) and non-postoperative delirium (non-POD) groups

Precipitating factors	Preoperative period			IPO		
	Non-POD (N=52)	POD (N=3)	*p*-value	Non-POD (N=52)	POD (N=3)	*p*-value
CAM positive	0 (0)	0	–	0	2 (66.66)	0.00[a,*]
Psychotropic drug use	7 (13.51)	2 (66.66)	0.06[a]	0	0	
Pain	0	0	–	3 (5.81)	1 (33.3)	0.16[a]
Pain level, mean (SD)	0	0	–	0.41 (1.64)	1 (1.61)	0.11[a]
Pain level, min–max	–	–	–	2–9	3	–
Bed restriction	1 (1.91)	0	1.00[a]	18 (34.63)	3 (100)	0.02[a,*]
Urinary catheterization	19 (36.52)	2 (66.66)	0.57[a]	29 (55.81)	2 (66.66)	0.06[a]
Physical restraints	1 (1.91)	0	1.00[a]	0	0	–
Dehydration	1 (1.91)	0	1.00[a]	0	0	–
Iatrogenic event	1 (1.91)	0	1.00[a,a]	0	0	–
Complications during hospitalization	2 (3.82)	0	1.00[a]	0	0	–
Electrolyte disorder	1 (1.91)	0	1.00[a]	0	0	–
Infection	2 (3.82)	1 (33.33)	1.00[a]	4 (7.67)	1 (33.3)	0.17[a]
Sensory deprivation	3 (5.73)	0	1.00[a]	0	0	–
Sleep deprivation	5 (9.55)	0	1.00[a]	0	0	–

Notes: [a]Fisher–Exact test. *Statistically significant ($P<0.05$). Data shown as n (%) unless indicated otherwise.
Abbreviations: CAM positive, identification of delirium using the Confusion Assessment Method; IPO, immediate postoperative period; D2, postoperative day 2; POD, postoperative delirium.

calcium) and used an inappropriate medication for the elderly (promethazine). He had used a Foley's catheter for 6 months and was restricted to bed. He had several predisposing risk factors including dementia, vision and hearing impairment, activity limitation and history of alcohol use. He experienced pain in the immediate postoperative period (pain intensity of 3). The episode of delirium lasted until postoperative day 3, and he was discharged on postoperative day 4. Tables 2 and 3 show a detailed description of his predisposing and precipitating factors.

Although not statically significant, the POD group had a longer hospital stay and more precipitating factors (psychoactive drug and urinary catheter use).

Discussion

The present study evaluated a healthy population undergoing a low-to-medium complexity endoscopic procedure.[13] The prevalence of POD was 5.45% and the episodes of POD lasted 3±1 days. These findings are in accordance with previous reports.[4,5,14]

There are few studies on POD incidence following low-to-medium complexity surgical procedures. This study demonstrated that POD is not an uncommon complication of minor surgical procedures and may be associated with in-hospital mortality.[15] Patients experiencing POD following transcatheter aortic valve replacement are at increased risk for in-hospital mortality,[16] suggesting that surgery complexity, patient frailty and precipitating and predisposing factors are associated with this condition.

One participant in our study died (1.81%), though the immediate cause of death is not known. We also found a higher 30-day in-hospital mortality rate than that reported in Austria (0.10%)[17] and the United States (0.66%).[18] The patient who died developed intraoperative hypotension, which is a risk factor associated with POD[6] after TURP.[19] Brain hypoperfusion may explain this finding.[20]

Regarding precipitating and predisposing factors for POD, age[19,21,22] and preoperative use of benzodiazepines[21] were factors associated with POD in elderly patients undergoing various types of low-complexity surgical procedures. The participants who received psychoactive drugs while in the hospital were more likely to have POD, which was shown to be independent of preoperative cognitive impairment in another study of patients admitted for hip fracture surgery.[23] However, there were other reports of no differences in demographic characteristics, number of medications used (including anticholinergics and benzodiazepines) and number of comorbidities as predictors of delirium.[24] Moreover, a recent meta-analysis from the United Kingdom[25] concluded that there is low-quality evidence associating POD with medication use in patients undergoing hip fracture surgery.

In our study, only one participant reported a pain level of 5 (0–10 scale) in the POD group. Therefore, it was not possible to determine whether pain is a precipitating factor, which is in contrast with a study from China that found that patients who developed POD following TURP referred more pain postoperatively than non-POD patients.[5] Regarding morbidity, CCI score was not a predictor of POD. However, this same study from China reported a significant association of a comorbidity level of two with POD.[5] In Northeast Brazil, patients often do not know their health conditions and do not inform them to health providers. For instance, Patient 3 was taking levodopa but he did not mention he had Parkinson's disease.

Interestingly, a significant number of participants in our study refused to answer MMSE scale questions and thus this tool could not be used as a predictor of POD. One explanation for this finding is that less-educated patients may find it difficult to take this test. It also may suggest that MMSE scale is not a good assessment tool for a population undergoing surgery. However, a study from China found that MMSE is an essential predictor of POD.[4] We also used the IQCODE scale in our study. Although it is easily administered, it did not allow to predict POD, probably because of the small number of participants experiencing POD and the scale's narrow numerical range (0–5).

In our study, we found that ADL and IADL dependency was associated with POD following TURP. Impairment in IADL has been described as a risk factor for POD in patients undergoing urological procedures.[4,19] Additionally, to the best of our knowledge, this is the first study reporting an association of ADL dependency with POD following TURP. Indeed, it seems important to assess functional capacity in patients undergoing other surgical procedures. Loss of functional capacity resulting in ADL and IADL dependency was a factor associated with POD in patients undergoing hip fracture surgery.[23] BI and MMSE and IADL results were reported as independent factors associated with POD after gastrointestinal surgery.[26] Also, a recent meta-analysis identified functional dependence as a predictor of postoperative complications in patients with gastric cancer.[27]

Our study has some limitations. The sample size was small because participants had to enter the study and undergo careful evaluation before the surgical procedure, but most of them were admitted to the hospital on the same day of surgery. In addition, the number of participants experiencing POD was small, making it difficult the interpretation of the results of the statistical analyses, though the incidence of POD was similar to that reported in the literature.

Yet, our study has some strengths. Although the results are not new in other populations, to the best of our knowledge, this is the first study to assess POD incidence in elderly patients undergoing TURP in Northeast Brazil. The participants underwent thorough evaluation for delirium by a skilled medical team trained to identify POD. This multidisciplinary team comprised a geriatrician, an internist, urologists and anesthesiologists. Cognitive and functional tests were administered, which allows comparisons with other patient populations. For improving care for the elderly, functional capacity should be assessed in all patients undergoing TURP. Surgeons will be able to identify patients at risk of POD and establish delirium prevention measures to prevent in-hospital complications such as death, prolonged hospital stay and increased costs.

As a conclusion, we found that functional dependence is associated with POD even in patients undergoing low-complexity urological procedures (TURP). Studies with POD patients are important to be conducted in patients of all ethnicities and socioeconomic backgrounds.

Disclosure

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