


Predictors of Postoperative Cognitive Decline in Very Old Patients With Hip Fracture: A Retrospective Analysis

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Abstract

Background: To investigate incidence and predictors of the various postoperative cognitive declines in old patients with hip fracture. **Methods:** This retrospective chart study evaluated 411 patients (age ≥ 80 years, follow-up 5 years). After exclusion of 82 patients (preexisting dementia or delirium), 70 patients showing either diagnosed postoperative delirium (POD; group 1; N = 18, 5.5%) or an unspecified cognitive dysfunction and behavior (group 2; N = 52, 15.8%) were analyzed and compared with those without any acute postoperative cerebral impairment (control group; N = 259, 78.7%). Medical history, anesthesiological, orthopedic, and rehabilitation data were assessed using the medical database of the hospital information system. Relative ratio was calculated with Fisher exact test: *P* value Bonferroni corrected $\leq .003$. **Results:** Acute cognitive complications were observed in 70 (21.3%) patients. Our data in group 1 showed that patients with a medical history of stroke (relative risk [RR] = 16.2, *P* = .0001) or nicotine abuse (RR = 14.4, *P* = .001) and perioperative surgical bleeding (RR = 6.54, *P* = .002) are more likely to develop POD. Unspecified cognitive dysfunction and behavior (group 2) was significantly associated with a medical history of stroke (RR = 12.5, *P* = .0001) and postoperatively with depression (RR = 3.32, *P* = .001). In the follow-up, significantly more patients in group 1 (55.6%, RR = 21.8, *P* = .0001) and group 2 (13.5%, RR = 3.88, *P* = .001) developed dementia as compared to controls (1.9%). Mortality did not differ significantly between the groups (group 1: RR = 1.75, *P* = .5 and group 2: RR = 0.66, *P* = 1.0). **Conclusion:** These data show that various predictors can identify a greater likelihood of developing postoperative cognitive decline in very old patients with hip fracture. Not identifying or labeling of POD limits the opportunity for evaluation, treatment, and planning. Thus, routine cognitive assessments need to be performed in the scope of multidisciplinary orthogeriatric comanagement.

Keywords

geriatrics, hip fracture, delirium, dementia, predictor

Introduction

Very old patients with a hip fracture often need surgery requiring anesthesia and are presumably at a greater risk of complications. Development of postoperative cognitive dysfunction may be evident and can be a key issue for increased morbidity and delayed functional recovery in the early and late postoperative period up to the rehabilitation phase,¹⁻³ resulting in prolonged hospital stay and increased health care costs.³ In the postoperative phase, patients often have cognitive dysfunction, for example, postoperative delirium (POD), depending on the type of surgery and anesthesia performed.^{2,4,5} A high incidence of POD is postulated for older patients with hip fracture.⁶ Furthermore, patients or their relatives report disturbances in memory, attentiveness disorder, confused wording, or common behavior changes.^{7,8} Additionally, some patients who do not meet the criteria for delirium develop cognitive changes.⁹ All these facts may pose an important problem in the early and late

postoperative period in terms of delayed mobilization and rehabilitation, resulting in longer hospital stay.¹⁰ However, attention should be paid to older patients with hip fracture who have an incidence of up to 50% for postoperative cognitive dysfunction and the possible predictors thereof.^{9,11,12} Furthermore,

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the dimension of a group of cognitive changes of unrecognized “subsyndromal delirium” that for various reasons do not rise to the level of labeling in a noncomprehensive fracture program is the rationale for actually studying this particular group. Thus, the aim of our study was to determine incidence and predictors of the different postoperative cognitive declines, namely POD or cognitive changes not meeting a definition of delirium, in order to better understand who of the very old patients with hip fracture is at risk of developing this outcome.

Study Design and Methods

Patients and Ethics

This subgroup analysis of a retrospective chart study performed in older patients scheduled for acute hip fracture surgery at Innsbruck Medical University between 2005 and 2007 and followed up until 2012 was approved by the ethics committee of Innsbruck Medical University (UN3597/2009). Inclusion criteria were patients with hip fracture aged >80 years undergoing surgery under either general or regional anesthesia. Exclusion criteria were incomplete data records defined as a lack of more than 50% of the data needed for inclusion and hospital readmission because of a second fracture, meaning that the first hospitalization was included in this study and the second not, so that the characteristics of such patients were not counted twice. Additionally, those patients whose medical history stated or who were described as having preexisting delirium and/or dementia were excluded for further analysis.

Study Design and Group Assignment

The incidence of postoperative cognitive decline defined as a deterioration of cognitive function greater than expected for age in a population of older patients with hip fracture was analyzed from medical records, and 2 groups, as given previously, were compared with the control group. The control group was defined as a group of patients without any postoperative cognitive decline.

- Group 1: diagnosed POD

Patients in group 1 were defined as those whose charts showed the diagnosis of POD according to the *Diagnostic and Statistical Manual of Mental Disorders* (Fourth Edition) criteria for delirium.^{9,13} We were not able to verify all the criteria for and the time sequence of this cognitive outcome; this was operationalized as a diagnosis of delirium entered in the chart by a physician. Thus, only those patients with hip fracture having no preexisting cognitive impairment, who underwent surgery under anesthesia and developed POD, were included (Tables 1 and 2).

- Group 2: unspecified cognitive dysfunction and behavior

Unspecified cognitive dysfunction and behavior is defined as any symptoms of confusion that were not specially diagnosed as POD in the charts. Several clinical descriptions of

cognitive dysfunction or behavior were taken from the nurses' notes but were not registered as a diagnosis. Such clinical descriptions were confusion, disorientation, agitation, disturbance of memory, and uncontrolled removal of urinary or other catheters. They were summarized as “unspecific cognitive dysfunction and behavior” and listed in Tables 1 and 3. We therefore included all patients with no preexisting cognitive impairment, who underwent surgery under anesthesia and who showed at least 1 note in their medical charts interpreting these symptoms as unspecified cognitive behavior.

Prior to establishing a comanaged program at our university hospital, all data were derived from the medical database of the hospital information system at Innsbruck Medical University. At the time of their hospital stay, the patients were not routinely followed by a geriatrician or internist on a daily basis. For the follow-ups, we also searched the charts of the nearby rehabilitation hospitals Hochzirl Geriatric Rehabilitation Hospital and Natters Hospital. To find a follow-up diagnosis of dementia and/or mortality in the charts, patients were followed for at least 5 years. Additionally, mortality records kept by the Austrian government were searched. Chart abstraction was performed by 2 clinicians and 1 medical student simultaneously. For interrater reliability, all ratings were checked twice and crosswise. It should be pointed out that the purpose of this study was to show the incidence and predictors of POD before setting up an orthogeriatric comanaged program, like that of “The Tyrolean Geriatric Fracture Center.”^{14,15}

Variables

As demographic data, we evaluated age, gender, and American Society of Anesthesiologists classification. Additionally, the type of fracture and surgery, time to surgery (hours), hospital stay (days), pre-, and postoperative stay in a nursing home were listed. The medical records were searched for diagnoses of a postoperative cerebral complication, as defined in groups 1 and 2.

Additionally, we recorded all other diseases listed in the medical history that were of interest, for example, stroke, myocardial infarction, atrial fibrillation, chronic obstructive pulmonary disease, diabetes mellitus, pneumonia, rheumatoid disease, liver, and kidney diseases. Additionally, complications such as arrhythmia, transfusion as a marker of postsurgical bleeding, urinary infection, pulmonary embolism, myocardial infarction, renal insufficiency, and pneumonia were included in our analysis.

Statistical Analysis

The primary goal of this chart study was to identify predictors for a POD. Therefore, it was of interest to look at the medical history and perioperative complications. Using the SPSS software (IBM Software SPSS, Version 20), the incidence of each of the outcomes was calculated and presented as absolute frequency. Comparisons between groups were made by relative risk (RR), and Fisher exact test was used to test for differences between groups. Due to the limited statistical power of the

Table 1. Characteristics and 5-Year Follow-Up in Very Old Patients With Hip Fracture Without Preexisting or Medical History of Dementia or Delirium: Demographic Data for Group 1 (Postoperative Delirium [POD]; N = 18), Group 2 (Unspecified Cognitive Dysfunction and Behavior; N = 52), and Control Group (N = 259).

	Group 1	Group 2	Control
Demographic data			
Sex			
Female (%)	13 (72.2)	38 (73.1)	225 (86.9)
Male (%)	5 (27.8)	14 (26.9)	34 (13.1)
Age, years	87.9 ± 4.5 (81-97)	88.8 ± 5.3 (81-100)	88.4 ± 5.2 (81-104)
ASA (mean)	2.9 ± 0.6 (2.0-4.0)	88.4 ± 5.2 (1.0-4.0)	2.8 ± 0.6 (1.0-4.0)
Time to surgery, hours			
≤24	20.1 ± 12.9	26.8 ± 28.8	25.8 ± 24.7
>24	10 (55.6)	31 (59.6)	163 (62.9)
	8 (44.4)	21 (40.4)	96 (37.1)
Anesthesia			
General anesthesia	8 (44.4)	21 (40.4)	87 (33.6)
Regional anesthesia	10 (55.6)	31 (59.6)	172 (66.4)
Type of femur fracture			
Femoral neck	11 (61.1)	17 (32.7)	121 (46.7)
Pertrochanteric	7 (38.9)	30 (57.7)	112 (43.2)
Subtrochanteric	0	5 (9.6)	26 (10.0)
Surgery			
Proximal femoral nail	4 (35.7)	23 (44.2)	96 (37.1)
Dynamic hip screw	6 (25.0)	20 (38.5)	74 (28.6)
Hemiarthroplasty	8 (39.3)	8 (15.4)	72 (27.8)
Cannulated screws	0	1 (1.9)	13 (5.0)
Other	0	0	4 (1.5)
Hospital stay, days			
≤14	12.4 ± 6.1	13.9 ± 6.9	13.7 ± 7.5
>14	12 (66.7)	35 (67.3)	174 (67.2)
	6 (33.3)	17 (32.7)	85 (32.8)
Prehospital home circumstances: lived			
In a nursing home	4 (25.0)	17 (32.7)	61 (23.6)
At home	14 (75.0)	35 (67.3)	198 (76.4)
Posthospital home circumstances: lived			
In a nursing home	6 (33.3)	21 (40.2)	80 (30.9)
At home	11 (61.1)	171 (66.0)	171 (66.0)
Hospital mortality	1 (5.6)	1 (1.9)	8 (3.1)
Follow-up			
Postoperative dementia			
Within 5 years	10 (55.6) ^a	7 (13.5) ^a	5 (1.9)
Mortality (cumulative)			
1 month	1 (5.6)	2 (3.8)	7 (2.7)
3 months	2 (11.1)	3 (5.8)	12 (4.6)
1 year	4 (22.2)	3 (5.8)	24 (9.3)
3 years	5 (27.8)	8 (15.4)	46 (17.8)
>3 years	5 (27.8)	9 (17.3)	64 (24.7)

Abbreviations: ASA, American Society of Anesthesiologists classification; RR (95% CI), relative risk (95% confidence interval).

^aUnpaired student *t* test, *P* value with Bonferroni correction <.003.

study and the low prevalence of POD, multivariate analysis was not appropriate and thus only univariate analysis was performed. Demographic data, presented as mean (with standard deviation), were tested with the unpaired Student *t* test. A *P* value, with Bonferroni correction for multiple testing, of <.003 was deemed significant.

Results

This retrospective chart study evaluated 411 patients (age ≥80 years, follow-up 5 years). After exclusion of 82 patients with a history of and/or preexisting dementia and delirium, we

observed in a total of 329 patients (female/male: 276/53 [83.9%/16.1%]; age: 81-104 years) a diagnosis of POD (group 1) or an unspecified cognitive dysfunction and behavior (group 2) in 70 (21.3%) patients (Figure 1).

Group 1: Diagnosed POD

Postoperative delirium was diagnosed in 18 (5.5%) patients during hospital stay. Demographic characteristics of group 1 are listed in Table 1, demonstrating no significant differences as compared to the control group. Mortality did not differ significantly between the groups (*P* = .5; Table 1). Patients with

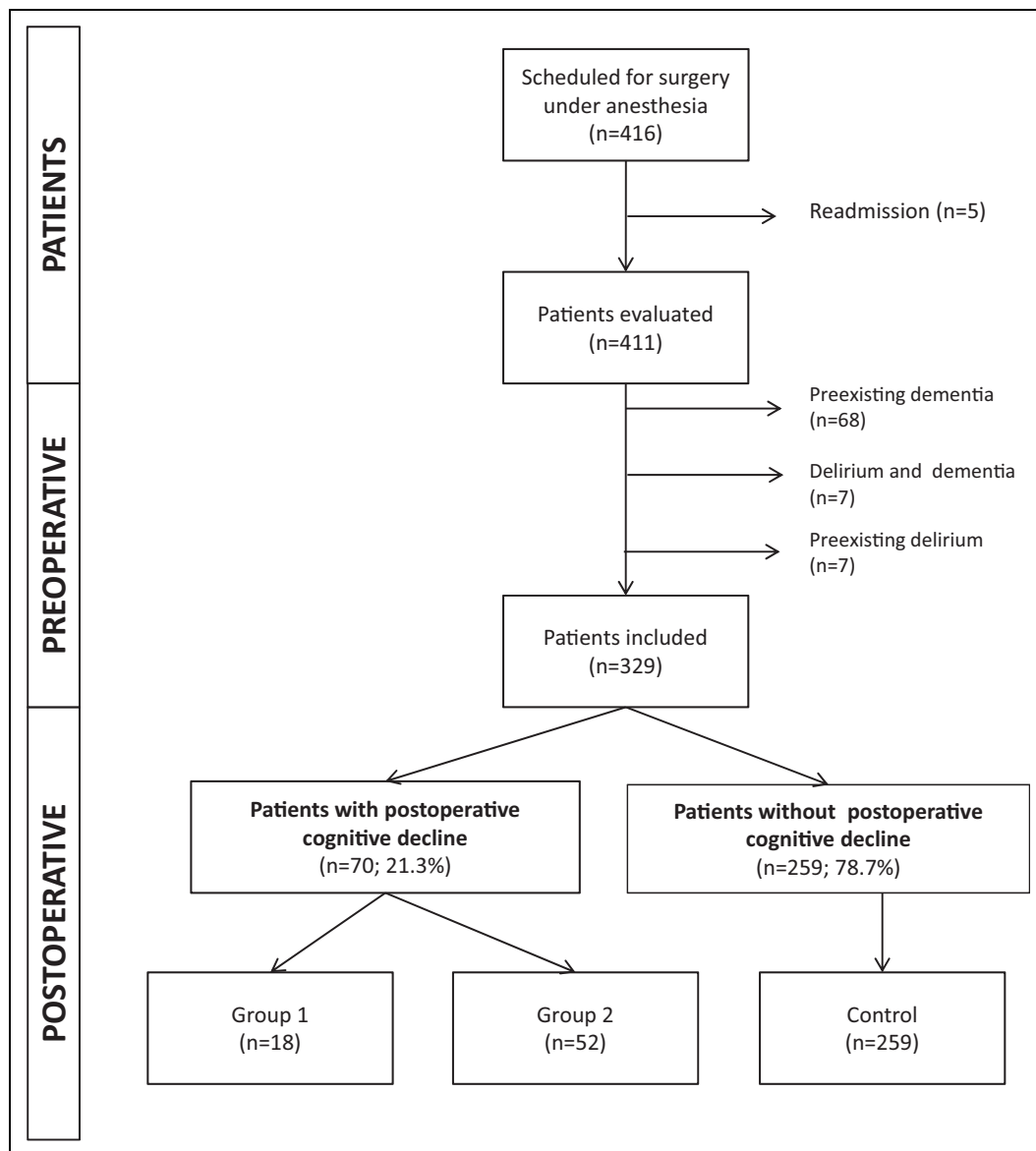


Figure 1. Study design: group 1: diagnosed POD and group 2: unspecified cognitive dysfunction and behavior. POD indicates postoperative delirium.

POD showed a significantly increased incidence in previous medical history of stroke (RR = 16.2, $P = .0001$) and nicotine abuse (RR = 14.4, $P = .001$; Table 2). Patients with increased perioperative bleeding (RR = 6.54, $P = .002$) were more likely to develop POD (Table 2); postoperative stroke showed only borderline significance (RR = 14.4; $P = .02$). In the 5-year follow-up, significantly more primarily patients with nonpreexisting dementia in group 1 developed postoperative dementia than did controls ($P = .0001$; Table 1).

Group 2: Unspecified Cognitive Dysfunction and Behavior

Symptoms of an unspecified cognitive dysfunction and behavior were seen in 52 (15.8%) patients. This small number seems to be a matter of labeling. As listed in Table 1, demographic data showed a trend to more male patients ($P = .01$)

in group 2 with a trend to a higher incidence of pertrochanteric ($P = .07$) and a lower incidence of femoral neck fracture ($P = .07$) and hemiarthroplasty ($P = .08$). Mortality did not differ significantly between the groups ($P = 1.0$; Table 1). A medical history of stroke (RR = 12.5, $P = .0001$) was a significantly increased predictor in patients showing postoperative unspecified cognitive behavior (Table 3). As postoperative risk factors, depression (RR = 3.32; $P = .001$) and a trend to urinary infection (RR = 1.49; $P = .07$) were observed (Table 3). In the 5-year follow-up, postoperative dementia was seen significantly more often in group 2 than in the controls ($P = .001$; Table 1).

Discussion

This retrospective chart study reveals that a postoperative cognitive decline, namely POD or unspecified cognitive

Table 2. Diagnosis of Postoperative Delirium (POD) in Patients Without Medical History of or Preexisting Dementia or Delirium: Relative Risk for the Incidence of POD in Those With or Without Various Diseases in the Medical History and Complications for Group 1.

Possible Predictors of POD	With	Without	RR (95% CI)	P Value
Medical History				
Depression	3 (27.3)	15 (5.6)	5.40 (1.17-19.8)	.03
Stroke	9 (52.9)	9 (3.5)	16.2 (6.39-38.1)	.0001 ^a
PAOD	2 (9.5)	16 (6.3)	1.11 (0.18-4.00)	.7
Hypertension	11 (6.3)	7 (6.9)	0.96 (0.56-1.31)	.8
Coronary heart disease	9 (7.8)	9 (5.6)	1.15 (0.57-1.84)	.6
Myocardial infarction	2 (8.7)	16 (6.3)	1.37 (0.23-5.08)	.7
Atrial fibrillation	3 (4.5)	15 (7.1)	0.67 (0.17-1.79)	.6
Heart insufficiency	9 (9.4)	9 (5.0)	1.49 (0.78-2.27)	.2
Heart valve disease	3 (9.1)	15 (6.1)	1.44 (0.36-4.05)	.5
Pneumonia	1 (4.8)	17 (6.6)	0.72 (0.04-4.28)	1.0
COPD	6 (10.5)	12 (5.5)	1.69 (0.70-3.21)	.2
Liver disease	1 (14.3)	17 (6.3)	2.40 (0.11-18.3)	.4
Kidney disease	9 (10.8)	9 (4.6)	1.75 (0.91-2.69)	.1
Rheumatoid disease	0	18 (6.8)	0.00 (0.00-5.00)	1.0
Diabetes mellitus	2 (3.4)	16 (7.3)	0.51 (0.09-1.75)	.4
Cancer	3 (4.7)	15 (7.0)	0.71 (0.18-1.88)	.8
Osteoporosis	7 (7.9)	11 (5.9)	1.23 (0.56-2.11)	.6
Sarcopenia	0	18 (6.6)	0.00 (0.00-12.4)	1.0
Decubitus	2 (18.2)	16 (6.0)	3.20 (0.48-14.0)	.2
Nicotine abuse	4 (50.0)	14 (5.2)	14.4 (3.17-65.2)	.001 ^a
Alcohol abuse	1 (7.1)	17 (6.5)	0.68 (0.03-4.29)	1.0
Complication				
Depression	2 (10.0)	16 (6.2)	1.60 (0.26-6.06)	.6
Stroke	2 (50.0)	16 (5.9)	14.4 (1.48-139.7)	.02
Myocardial infarction	1 (25.0)	17 (6.2)	4.80 (0.19-49.5)	.2
Atrial fibrillation	0	18 (6.8)	0.00 (0.00-4.98)	1.0
Pneumonia	3 (12.5)	15 (5.9)	2.06 (0.50-6.05)	.2
Pulmonary embolism	0	18 (6.6)	0.00 (0.00-15.6)	1.0
Deep vein thrombosis	0	18 (6.6)	0.00 (0.00-20.8)	1.0
Acute renal insufficiency	0	18 (6.7)	0.00 (0.00-10.3)	1.0
Urinary infection	5 (6.6)	13 (6.5)	1.01 (0.38-2.05)	1.0
Diarrhea	2 (9.5)	16 (6.3)	1.51 (0.25-5.70)	.6
Perioperative bleeding	5 (31.3)	13 (5.0)	6.54 (2.09-17.4)	.002 ^a
Blood transfusion	4 (5.6)	14 (6.8)	0.86 (0.28-1.95)	1.0

Abbreviations: COPD, chronic obstructive pulmonary disease; PAOD, peripheral artery occlusive disease; RR (95% CI), relative risk (95% confidence interval).

^aChi-square test and Fisher exact test, *P* value with Bonferroni correction <.003.

dysfunction and behavior, was seen in approximately 21% of very old patients with hip fracture. This finding is supported by other authors reporting a delirium prevalence of up to 62% in such patients with hip fracture in the postoperative setting, for example, postanesthesia care unit.¹⁶⁻¹⁹ Our observation of a low POD frequency of 5.5% is comparable with that of Edelstein et al, namely 5.1%,²⁰ and stands in contrast to that of Gleason who reported that delirium affects up to 30% of hospitalized patients with medical illness and more than 50% of persons in certain high-risk populations.⁹

The etiology of POD appears to be multifactorial including factors such as age, preoperative cognitive dysfunction, general health status, and perioperative events,²¹ and attention should be paid to possible predictors for such postoperative cognitive dysfunction^{11,12} in order to prevent these disease patterns and thus increased morbidity, delayed mobilization, and rehabilitation resulting in longer hospital stays.^{3,10} The clinical pictures of

cerebral complications—POD and unspecified cognitive dysfunction and behavior—point to some preoperative predictors and perioperative risk factors that may help identify clinical signs of a developing postoperative complication, especially cognitive dysfunction.

Preoperative predictors for POD in very old patients with hip fracture were a medical history of stroke, dementia, and nicotine abuse. The associations between POD and an underlying dementia as well as preoperative cognitive dysfunction and age are well documented.^{17,20,22-26} The fact that a medical history of stroke is a preoperative predictor of POD is explained by the fact that this disease is also a major contributor to dementia in later years and one of the pathophysiological mechanisms in mainly vascular dementia.^{27,28} Furthermore, stroke is followed by a high risk of subsequent dementia.²⁹⁻³³ This close link between dementia and stroke possibly explains why it is a risk factor for POD and vice versa. The association

Table 3. Unspecified Cognitive Dysfunction and Behavior in Patients Without Medical History of or Preexisting Dementia or Delirium: Relative Risk for the Incidence of Unspecified Cognitive Dysfunction and Behavior in Those With or Without Various Diseases in the Medical History and Complications for Group 2.

Possible Predictors of Unspecified Cognitive Behavior	With	Without	RR (95% CI)	P Value
Medical History				
Depression	3 (27.3)	49 (16.3)	1.87 (0.40-7.42)	.4
Stroke	20 (71.4)	32 (11.3)	12.5 (5.59-29.3)	.0001 ^a
PAOD	3 (13.6)	49 (17.0)	0.79 (0.19-2.63)	1
Hypertension	39 (19.1)	13 (12.1)	1.18 (0.94-1.38)	.2
Coronary heart disease	22 (17.2)	30 (16.4)	1.03 (0.69-1.45)	.9
Myocardial infarction	7 (25.0)	45 (15.9)	1.66 (0.66-3.84)	.3
Atrial fibrillation	18 (22.0)	34 (14.8)	1.40 (0.86-2.15)	.2
Heart insufficiency	23 (20.9)	29 (14.4)	1.32 (0.88-1.85)	.2
Heart valve disease	4 (11.8)	48 (17.3)	0.66 (0.20-1.84)	.6
Pneumonia	4 (16.7)	17 (16.7)	1.00 (0.29-2.89)	1
COPD	11 (17.7)	41 (16.5)	1.07 (0.55-1.93)	.8
Liver disease	2 (25.0)	50 (16.5)	1.66 (0.23-8.78)	.6
Kidney disease	13 (14.9)	39 (17.4)	0.88 (0.49-1.45)	.7
Rheumatoid disease	0	52 (17.4)	0.00 (0.00-1.87)	.1
Diabetes mellitus	14 (20.0)	38 (15.8)	1.26 (0.70-2.07)	.5
Cancer	17 (21.8)	35 (15.0)	1.39 (0.83-2.17)	.2
Osteoporosis	14 (14.6)	38 (17.7)	0.85 (0.49-1.37)	.6
Sarcopenia	0	52 (17.0)	0.00 (0.00-4.52)	.6
Decubitus	2 (18.2)	50 (16.7)	1.11 (0.17-5.24)	1
Nicotine abuse	5 (27.8)	47 (16.0)	1.92 (0.61-5.47)	.2
Alcohol abuse	2 (33.3)	50 (16.4)	2.49 (0.32-15.4)	.3
Complication				
Depression	12 (40.0)	40 (14.2)	3.32 (1.458-6.75)	.001 ^a
Stroke	2 (50.0)	50 (16.3)	4.98 (0.51-48.9)	.1
Myocardial infarction	0	52 (16.9)	0.00 (0.00-10.9)	1
Atrial fibrillation	4 (23.5)	48 (16.3)	1.53 (0.43-4.78)	.5
Pneumonia	6 (22.2)	46 (16.2)	1.42 (0.53-3.48)	.4
Pulmonary embolism	0	52 (17.0)	0.00 (0.00-7.46)	.6
Deep vein thrombosis	0	52 (16.9)	0.00 (0.00-5.64)	1
Acute renal insufficiency	2 (22.2)	50 (16.6)	1.42 (0.21-7.18)	.6
Urinary infection	21 (22.8)	31 (14.2)	1.47 (0.94-2.15)	.07
Diarrhea	7 (26.9)	45 (15.8)	1.84 (0.72-4.32)	.2
Perioperative bleeding	5 (31.3)	47 (15.9)	2.26 (0.70-6.71)	.2
Blood transfusion	16 (19.3)	36 (15.8)	1.19 (0.70-1.88)	.5

Abbreviations: COPD, chronic obstructive pulmonary disease; PAOD, peripheral artery occlusive disease; RR (95% CI), relative risk (95% confidence interval).
^aChi-square test and Fisher exact test, P value with Bonferroni correction <.003.

between nicotine abuse and delirium is supported by previous studies, and it appears that tobacco use and/or nicotine withdrawal are often underrecognized predictive risk factors for delirium.^{17,34,35} Conversely, nicotine withdrawal might be associated with an increased incidence of agitation but not with delirium.³⁶ Furthermore, surgical bleeding was identified as a perioperative trigger that was previously reported in the association between greater surgical blood loss/greater intraoperative transfusion and delirium.¹⁷ However, the intraoperative need for transfusion was not significant in our setting.

It should be remembered that many signs and symptoms of delirium are also present in conditions such as dementia.⁹ Preexisting dementia is a well-known risk factor for POD, and it is obvious that patients with dementia are vulnerable for delirium.³ Although we excluded these patients, it should be noted that in the preoperative setting, the diagnosis of this disease, especially

mild dementia, is often missed in the medical history. It appears to be evident postoperatively and at this point it is very difficult to distinguish between delirium and dementia. An association between POD and the development of dementia at a later time was also seen in our follow-up results. Nevertheless, this clearly shows that a greater awareness is needed for possible dementia, especially in the early stages.

Postoperative delirium is well described,³ but in our study, we found an unspecified cognitive behavior other than diagnosed POD. We are aware that self-reporting of cognitive functions correlates poorly with objective testing.¹⁷ Our observed 15.8% incidence of unspecified symptoms is within the broad range of 10% to 41% seen for major noncardiac surgery in middle-age and old patients.³⁷⁻⁴¹ However, the use of health care descriptions such as “confused people” may make it difficult to distinguish between delirium and dementia as discussed

previously.¹⁹ Furthermore, we found that very old male patients with a trend to either a femoral femur fracture or a pertrochanteric fracture are at greater risk when they have a previous medical history of preoperative stroke, as well as postoperative depression and a trend to urinary infection complications. This finding has been described previously in reports of a relationship between postoperative cerebral dysfunction and advancing age,³⁷⁻³⁹ type of surgery,³⁹ cognitive decompensation in men,³ preexisting decreased cognitive dysfunction,^{21,24} preexisting delirium,¹⁶ and surgical bleeding including a reduced hematocrit of <30%,⁴² and maintenance of homeostasis.⁴⁰ A history of depression seems to have no impact on the incidence of POD,⁴³ whereas depression as a complication may be associated with an unspecified cognitive behavior or a greater risk of POD.⁴⁴ However, in some cases in acutely ill older patients, it can be difficult to distinguish between depression and POD due to the fact that the clinical signs are comparable, particularly in patients having hypoactive delirium.⁴⁵

As limitations we must stress that this is a retrospective study and that the charts show only POD, dementia, or unspecific cognitive symptoms. At less than 6%, the prevalence of diagnosed delirium is very low, likely in part due to the lack of routine screening on arrival at the hospital prior to developing the Tyrolean Geriatric Fracture Center program. It is not ruled out that the validity of the analysis of predictors is compromised since no multivariate analyses could be performed. A larger study would seem opportune in order to be more sure about possible confounding effects. Needless to say, specific test screening for POD or dementia in the majority of the patients was missing in this setting before starting an orthogeriatric comanaged program at our facility. Routine use of pre- and postoperative tests is needed to recognize all patients with cognitive disorders. Routine cognitive assessment including specific tests and guidelines¹⁹ was performed in the scope of multidisciplinary orthogeriatric comanagement like at “The Tyrolean Geriatric Fracture Center”^{14,15} to improve detection rates and prevent ignorance concerning this postoperative complication.¹⁹ Heightening awareness for postoperative cognitive outcome could improve medical care for this particular patient population, a fact emphasized by us by recommending further studies. However, in light of all these limitations, it is strongly recommended that a prospective study be conducted with a larger number of patients and including specific tests for cognitive disorders.

Conclusion

These data show that predictors can identify a greater likelihood of developing postoperative cognitive decline in very old patients with hip fracture. In this retrospective study, we identified a group of patients with cognitive changes in “subsyndromal” delirium that for various reasons do not rise to the level of labeling in a non-Tyrolean Geriatric Fracture Center-type program but that constitutes a larger group than those with identified delirium. This may have prognostic implications for the development of dementia. Thus, as a take-home message, we stress that not identifying or labeling POD limits the

opportunity for evaluation, treatment, and planning. Thus, routine cognitive assessments need to be performed in the scope of multidisciplinary orthogeriatric comanagement.

Authors' Note

TJL, SM, MG, and MFL designed the study; MFL, SM, CK, and TJL collected the data; TJL, MFL, and CK analyzed the data; MFL, SM, and TJL wrote the article; and CK and MG were involved in editing and critical revision of the article.

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