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Cognitive Impairment Level and Elderly Hip Fracture: Implications in Rehabilitation Nursing

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Abstract

Purpose: The aim of the study was to determine the cognitive impairment level influence in descriptive characteristics, comorbidities, complications, and pharmacological features of older adults with hip fracture.

Design: Cross-sectional study.

Method: Five hundred fifty-seven older adults with hip fracture were recruited and divided into cognitive impairment levels (severe/moderate, mild, no impairment). Descriptive characteristics, comorbidities, complications, and pharmacological data were collected.

Findings: Significant differences ($p < .05$, $R^2 = .012–.475$) between cognitive impairment levels were shown. Shorter presurgery hospital length of stay and lower depression and Parkinson comorbidities; delirium complication; and antidepressants, antiparkinsonians, and neuroleptics use were shown for the no-impairment group. With regard to the cognitive impairment groups, lower presence of cardiopathy and hypertension; higher presence of dementia; antihypertensives, antiplatelets, and antidementia medication; infection/respiratory insufficiency complications; and lower constipation complications were shown.

Conclusion: Cognitive impairment levels may determine the characteristics, comorbidities, pharmacology, and complications of older adults with hip fracture.

Clinical Relevance: Cognitive impairment level may impact rehabilitation nursing practice, education, and care coordination.

Keywords: Cognitive dysfunction; Frail elderly; Hip fractures; Musculoskeletal diseases.

Introduction

Hip fractures may be one of the most common musculoskeletal conditions secondary to the osteoporotic disorder, which may generate high morbid-mortality and economic burden (Boschitsch, Durchschlag, & Dimai, 2017). In the United States, these may be considered as one of the most important fractures, which negatively impact public health due to their high associated morbidity, mortality, and socioeconomic consequences (Burge et al., 2007). Across European countries, hip fracture incidence may be stated as an epidemic within a similar pattern, timing variability, and maximum rate of fractures (Lucas et al., 2017).

In Spain, hip fractures were shown to have high prevalence and incidence, as well as be frequently associated with trochanteric fractures, feminine gender, and older age over 85 years (Lobo et al., 2017; Pueyo-Sánchez et al., 2016). A trend to hip fractures increase in absolute numbers was reported, although there was a wide variability in the hip fractures incidence among different regions of Spain (Etxebarria-Foronda et al., 2015). Hip fractures in older adults may be associated with several comorbidities, which increase the risk of mortality. A 4.7% in-hospital mortality rate as well as 8.7%, 16.9%, and 25.9% mortality rates at 1, 6, and 12 months after hospital discharge, respectively, were reported in Spanish older adults with hip fracture (Padrón-Monedero et al., 2017; Tarazona-Santabalbina et al., 2012).

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Ethical Considerations:

The study was approved by the Clinical Research Ethics Committee of the León University (Spain; Code ÉTICA-ULE-004-2015). Informed written consent form was obtained from all participants before their inclusion in the research study. Furthermore, the Helsinki Declaration, Protection Data Organic Law (15/1999), and ethical standards in human experimentation were respected.

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Among these, cognitive impairment may increase the risk of mortality in older adults after hip fracture. Men developed more cognitive impairment scores within the first 22 days of hip fracture than women (Gruber-Baldini et al., 2017). Preoperative malnutrition may be a predictor of postoperative delirium after hip fracture surgery in older adults (Mazzola et al., 2017). According to the Delirium Motor Subtype Scale, motor subtype profiles (hyperactive, hypoactive, mixed, and no motor subtypes) appeared not to be associated with demographic or clinical characteristics of older adults with delirium after hip fractures (Scholtens et al., 2017). Older adults with preoperative dementia and postoperative delirium associated with hip fracture may increase the risk of mortality over the first postoperative year (Lee, Oldham, Sieber, & Oh, 2017).

An accumulated incidence of 24.0% was shown for delirium after hip surgery in elderly patients. Preoperative cognitive impairment, advanced age, living in an institution, heart failure, total hip arthroplasty, multiple comorbidities, and morphine usage may be considered as risk factors to sustain delirium in older adults after hip surgery (Yang et al., 2017). Surgical risk (American Association of Anesthesiologists [ASA] score) and complications (Shabani et al., 2015), conservative or invasive treatments (Kawaji, Uematsu, Oba, & Takai, 2016; Li & Zheng, 2016; Mosseri, Trinquart, Nizard, & Ravaud, 2016), comorbidities (Padrón-Monedero et al., 2017), and ambulation capacity (Hall, Williams, Senior, Goldswain, & Criddle, 2000) need to be associated with the cognitive impairment levels (severe, moderate, mild, and no impairment; Ariza-Vega, Lozano-Lozano, Olmedo-Requena, Martín-Martín, & Jiménez-Moleón, 2017; Silverstein & Deiner, 2013).

With regard to the Barthel index for activities of daily living (González-Zabaleta, Pita-Fernandez, Seoane-Pillado, López-Calviño, & Gonzalez-Zabaleta, 2015; Liu, Unick, Galik, & Resnick, 2015), Spanish orthogeriatric units described an average Barthel index score of 77.2 ± 27.8 points, a mean stay length of 8.9 ± 4.26 days, and a readmission rate of 2.3% in patients older than 70 years with hip fracture (Tarazona-Santabalbina et al., 2012). Male gender, Barthel index, heart failure, and cognitive impairment were related features to an increase of death risk in these patients. Considering the functionality at hospital discharge, 63.7%, 77.4%, and 80% of these older adults were capable to walk at the moment of discharge, 1 month after discharge, and 6 months after discharge, respectively. The key factors implicated in a worse functional recovery were performance status, age, stroke, comorbidity index score, delirium, and cognitive impairment during the hospital stay (Padrón-Monedero et al., 2017; Tarazona-Santabalbina et al., 2012). To the authors' knowledge, there are no previous research studies that investigate the cognitive impairment level influence in these key factors of older adults with hip fracture.

The quality of patient care outcomes may be directly related to rehabilitation nursing. Nurses should be capable to identify the key points of cognitive impairment features as a reference in the aging process of older adults with hip fracture (Blackburn, Locher, Morrisey, Becker, & Kilgore, 2016). Therefore, the aim of this study was to determine the influence of the cognitive impairment levels in the descriptive characteristics, comorbidity, possible complications, and pharmacological treatment and features at hospital discharge of older adults with hip fracture with implications in rehabilitation nursing.

Methods

Study Design

This study design was a cross-sectional descriptive study with a 1-year recruitment in order to determine the cognitive impairment level influence in older adults who suffered from hip fracture and recruited at the orthogeriatric unit from the University Hospital of León (Spain) from 2013 to 2014. The Strengthening the Reporting of Observational Studies in Epidemiology statement was followed (Vandenbroucke et al., 2014). The Clinical Intervention Ethics Committee from the University of León (Spain; Code ÉTICA-ULE-004-2015) approved this study, and informed consent forms were signed by the subjects or legal guardians before the study start.

Sample Size Calculation

The sample size was calculated by the software from Unidad de Epidemiología Clínica y Bioestadística, Complexo Hospitalario Universitario de A Coruña, Universidade da Coruña (available at http://www.fisterra.com/mbe/investiga/9muestras/9muestras2.asp; Pita Fernández, 1996). Considering the 1-year prevalence of 45,210 older adults with hip fracture in Spain (Azagra et al., 2014), the sample size calculation for an alpha level of .05 (confidence interval [CI], alpha – 1 = 95%), a proportion of 5% and a precision of ±2%, provided at least $n = 452$ cases. Furthermore, assuming information loss of 15%, at least $n = 531$ older adults with hip fracture must be included in the study (Pita Fernández, 1996).

Participants

A total sample of 557 older adults who suffered hip fracture was recruited by a consecutive sampling method. The setting was performed at the Orthogeriatric Department from the University Hospital of León (Spain). The inclusion criteria comprised older adults over 75 years old who were diagnosed of osteoporotic hip fracture (spontaneous

fractures without external forces and associated to osteoporosis) between 2013 (December) and 2014 (November) in this hospital department (Boschitsch et al., 2017). Nevertheless, secondary pathological fractures different from osteoporosis (i.e., neoplasia or osteomyelitis; Cornelis et al., 2017), traumatic fractures caused by an external force (Mehra et al., 2017), or periprosthetic fractures (Pavelka, Salášek, & Weisová, 2017) were excluded.

Outcome Measurements

The same authorized researcher extracted the data from the electronic and paper medical records with a time frame from the hospitalization to the hospital discharge. The cognitive impairment levels were considered to divide the sample into three groups (severe/moderate, mild, and no impairment) after an orthogeriatric medical diagnosis according to the Diagnostic and Statistical Manual of the American Psychiatric Association (DSM-V; Ariza-Vega et al., 2017; Silverstein & Deiner, 2013). Mild and moderate/severe cognitive impairment levels were considered according to the psychiatrist medical diagnosis. First, sociodemographic characteristics (gender and age), type of fracture (subcapital or pertrochanteric types), and total and presurgery hospital staying days were registered (Mosseri et al., 2016).

Second, baseline functionality, based on the Barthel index (total, ≤20; severe, 21–60; moderate, 61–90; slight, 91–99; or no dependence, 100; Liu et al., 2015), which has shown good reliability (Cronbach's alpha > .70), confirmed structural validity and capability to discriminate between groups, and detect changes at follow-up points in the evaluation of basic activities of daily living in older adults with different conditions such as hip fracture (González et al., 2017; González-Zabaleta et al., 2015), and ambulation capacity (independence/one stick, walker/two sticks, high assistance, no possibility to walk; Peiris et al., 2017) were registered. Associated comorbidities (cardiopathies, hypertension syndrome, depression disorder, dementia, diabetes, osteoarthritis, chronic renal failure, ictus, atrial fibrillation, visual impairment, anemia, osteoporosis, chronic obstructive pulmonary disease, cancer, multiple falls, peripheral vascular disease, Parkinson's disease, dysphagia, ischemic heart disease, aortic stenosis, and prior hip fracture) were collected (Padrón-Monedero et al., 2017).

Third, surgical features were detailed and comprised requirement of surgery intervention, urgency of surgery, type of surgery (nail, partial bipolar prosthesis, monopolar prosthesis, total prosthesis, and screws; Mosseri et al., 2016), ASA scores in order to evaluate surgical risk with moderate interrater reliability (κ = .61; Sankar, Johnson, Beattie, Tait, & Wijeysundera, 2014) and appropriated validity (Marufu, Mannings, & Moppett, 2015) in different degrees (Degree II–Moderate Systemic Disease, Degree III–Severe Nondisabling Systemic Disease, Degree IV–Severe Vital Risk Systemic Disease; Kastanis, Topalidou, Alpantaki, Rosiadis, & Balalis, 2016), and cause of nonsurgery (death, high surgical risk, orthopedic care, and hospital transfer; Shabani et al., 2015). Furthermore, pharmacological treatments at baseline (proton pump inhibitors, antihypertensives, benzodiazepines, antidepressants, antiplatelets, anticoagulants, antidementia, neuroleptics, antiparkinsonians, oral antidiabetic agents, analgesics, antiosteoporosis, bronchodilators, domiciliary oxygen, and insulin) were registered (Lönnbro & Wallerstedt, 2017).

Fourth, possible complications (anemia, transfusion, delirium, infection or respiratory insufficiency, constipation, renal function alteration, urinary tract infection, malnutrition, heart failure, acute retention of urine, seroma, surgical wound infection, ischemic heart disease, death, pressure ulcers, ictus, venous thrombosis, or thromboembolism; Kua, Ramason, Rajamoney, & Chong, 2016) as well as characteristics at hospital discharge (destination, home discharge, ambulation, and discharge features) were described (Regenbogen et al., 2017).

Finally, the outcome measurements, which were compared by cognitive status level, are presented in Figure 1, according to our main purpose.

Statistical Analysis

The statistical SPSS 22.0 software (IBM SPSS, Inc., Chicago, IL) was used. A 95% CI and a statistically significant p value of <.05 were utilized in the analysis data. First, the Kolmogorov–Smirnov test was used to test normality. Second, the data descriptive analysis was performed. Considering the quantitative variables, the mean ± standard deviation (*SD*), the Student's t test for independent samples for gender, and the one-factor analysis of variance completed with the multiple comparison test by means of the Tukey's post hoc analyses for cognitive impairment levels were applied. With regard to the rest of categorical variables, percentage and frequency to describe the data, as well as the chi-square (χ^2) test to determine differences between cognitive impairment levels, were used. Furthermore, the R^2 coefficient (~.050 for slight, ~.150 for moderate, ~.250 for high, ~.360 for large, and ~.450 for very large) was added to determine the effect size (Preacher & Kelley, 2011).

Results

Descriptive Data

A total sample of 557 older adults suffered from hip fracture between 2013 (December) and 2014 (November). In

COGNITIVE STATUS LEVEL (No-impairment; mild impairment; moderate/severe impairment)				
DESCRIPTIVE FEATURES	**COMORBIDITIES**	**PHARMACOLOGIC TREATMENTS**	**POSSIBLE COMPLICATIONS**	**FEATURES AT DISCHARGE**
Sociodemographic characteristics (sex and age); type of fracture (subcapital or pertrochanteric types); total and pre-surgery length of stay	Cardiopathies; hypertension syndrome; depression disorder; dementia; diabetes; osteoarthritis; chronic renal failure; ictus; atrial fibrillation; visual impairment; anemia; osteoporosis; chronic obstructive pulmonary disease; cancer; multiple falls; peripheral vascular disease; Parkinson's disease; dysphagia; ischemic heart disease; aortic stenosis; and prior hip fracture	Proton-pump inhibitors; anti-hypertensives; benzodiazepines; antidepressants; antiplatelets; anticoagulants; antidementia; neuroleptics; anti-Parkinsonians; oral antidiabetic agents; analgesics; anti-osteoporosis; bronchodilators; domiciliary oxygen; and insulin.	Anemia; transfusion; delirium; infection or respiratory insufficiency; constipation; renal function alteration; urinary tract infection; malnutrition; heart failure; acute retention of urine; seroma; surgical wound infection; ischemic heart disease; death; pressure ulcers; ictus; venous thrombosis or thromboembolism.	Destination (concerted care center, nursing, family or own home); home discharge (yes, no, hospital concerted center); ambulation (independence/1 stick, walker/2 sticks, high assistance, not walk); and discharge features.

Figure 1. Outcome measurements carried out by each cognitive status level.

addition, periprosthetic fractures (n = 19), pathological fractures (n = 4), and traumatic (n = 0) fractures were excluded. From these older adults (n = 534), 5.8% (n = 31) of these participants expired during admission, whereas 1.1% (n = 6) of these subjects were referred to another hospital for their intervention (n = 497). Considering these 534 older adults, an age mean ± *SD* of 86.66 ± 5.32 years (95% CI [86.21, 87.12], range: 75–105 years) and 74.7% (n = 399) of the women comprised the sample. Thus, the sample was mostly composed of women (χ^2 = 130.52, p < .001). Nevertheless, there were no statistically significant age differences (Student's t = .05, p = .959) between women (86.67 ± 5.44 years) and men (86.64 ± 4.97 years). In addition, the incidence of pertrochanteric fractures (55.1%, n = 294, 95% CI [50.82%, 59.29%]) seems to be more common (χ^2 = 5.46, p = .019) than subcapital fractures (44.9%, n = 240, 95% CI [40.71%, 49.18%]). With regard to the baseline functionality, the Barthel index showed total dependence (12.0%, n = 64), severe dependence (18.9%, n = 101), moderate dependence (29.8%, n = 159), slight dependence (6.9%, n = 37), or no dependence (32.4%, n = 173). Furthermore, the ambulation capacity showed independence or one cane (64.4%, n = 344), walker or two canes (26.0%, n = 139), high assistance (6.0%, n = 32), or no possibility to walk (3.6%, n = 19).

Surgical Features

The 93.4% (n = 499, 95% CI [91.3%, 96.6%]) of the sample received a surgical intervention with 275 (55.1%) nails, 139 (27.9%) partial bipolar prosthesis, 38 (7.6%) monopolar prosthesis, 29 (5.8%) total prosthesis, and 18 (3.6%) screws. Only 13.1% of the surgeries comprised surgical urgency. Among the causes of nonsurgery, death (2.8%), high surgical risk (1.3%), orthopedic care (1.3%), and hospital transfer (1.1%) were registered. Furthermore, ASA scores showed 1 (0.2%) Degree I–Normal Health, 129 (24.2%) Degree II–Moderate Systemic Disease, 335 (62.7%) Degree III–Severe Nondisabling Systemic Disease, and 69 (12.9%) Degree IV–Severe Vital Risk Systemic Disease.

Descriptive Data by Cognitive Impairment Level

With regard to the cognitive impairment grades, no impairment (n = 293, 77 men and 216 women, 121 subcapital and 172 pertrochanteric fractures, 11.49 ± 7.41 days), mild impairment (n = 109, 30 men and 79 women, 57 subcapital and 52 pertrochanteric fractures, 11.90 ± 5.28 days), and moderate/severe impairment (n = 132, 28 men and 104 women, 62 subcapital and 69 pertrochanteric fractures, 10.37 ± 5.81 days) did not show any statistically significant differences for gender (χ^2 = 1.95, p = .582, R^2 = .004), fracture type (χ^2 = 6.35, p = .096, R^2 = .012), or total hospital staying days (F = 1.86, p = .157, R^2 = .007). Nevertheless, the mean ± *SD* of length of stay (days) before surgery showed statistically significant differences (F = 4.17, p = .016, R^2 = .017) between no impairment (5.57 ± 4.19 days), slight (6.96 ± 3.62 days), and moderate/severe (5.95 ± 4.29 days) cognitive impairment levels. Indeed, the Tukey's post hoc analysis showed shorter hospital length of stay before surgery in favor of the no-impairment group with respect to the group with mild cognitive impairment level.

Comorbidities by Cognitive Impairment Level

With regard to Table 1, statistically significant differences between cognitive impairment levels among older adults with hip fracture were shown for lower presence of cardiopathy ($\chi^2 = 6.72$, $p = <.035$, $R^2 = .012$) and hypertension ($\chi^2 = 7.24$, $p = .027$, $R^2 = .013$) and higher presence of dementia ($\chi^2 = 481.80$, $p < .001$, $R^2 = .475$) in favor of the moderate/severe cognitive impairment level group, as well as lower presence of depression ($\chi^2 = 10.01$, $p = .007$, $R^2 = .018$) and Parkinson's disease ($\chi^2 = 6.83$, $p = .033$, $R^2 = .013$) in favor of the no-impairment cognitive group. There were no statistically significant differences ($p > .05$, $R^2 = .000–.009$) for the rest of the measurements.

Pharmacological Treatment by Cognitive Impairment Level

With respect to Table 2, statistically significant differences between cognitive impairment levels among older adults with hip fracture were shown for higher medication use of antihypertensives ($\chi^2 = 12.10$, $p = .002$, $R^2 = .022$) in favor of both groups with cognitive impairment and antiplatelets ($\chi^2 = 9.95$, $p = .007$, $R^2 = .018$) and antidementia ($\chi^2 = 217.53$, $p < .001$, $R^2 = .290$) in favor of the moderate/severe cognitive impairment level group, as well as lower medication use of antidepressants ($\chi^2 = 16.79$, $p < .001$, $R^2 = .031$) and antiparkinsonians ($\chi^2 = 9.54$, $p = .008$, $R^2 = .017$) in favor of the no-impairment cognitive group. Furthermore, neuroleptics medication use ($\chi^2 = 34.30$, $p < .001$, $R^2 = .061$) was higher in the moderate/severe cognitive impairment level group and lower in the no-impairment cognitive group. There were no statistically significant differences ($p > .05$, $R^2 = .002–.009$) for the rest of the measurements.

Complications by Cognitive Impairment Level

With respect to complications (Table 3), statistically significant differences between cognitive impairment levels among older adults with hip fracture were shown for lower presence of delirium ($\chi^2 = 17.28.99$, $p < .001$, $R^2 = .031$) in favor of the no-impairment cognitive group, as well as lower presence of constipation ($\chi^2 = 10.78$, $p = .005$, $R^2 = .020$) in favor of the moderate/severe cognitive impairment level group and higher presence of infection or respiratory insufficiency ($\chi^2 = 13.01$, $p < .001$, $R^2 = .024$) in favor of the mild cognitive impairment level group.

Table 1 Baseline Comorbidities of Older Adults with Hip Fracture by Cognitive Impairment Levels

		Cognitive Impairment Levels						
Comorbidities	*n*	(*n* = 293) No Impairment	(*n* = 109) Mild	(*n* = 132) Moderate/Severe	χ^2	*df*	p^a	Effect Size R^2
Cardiopathy	400	76.8% (225)	79.8% (87)	**66.7% (88)**	6.72	2	.035*	.012
Hypertension	377	73.4% (215)	74.3% (81)	**61.4% (81)**	7.24	2	.027*	.013
Depression	158	**24.2% (71)**	39.4% (43)	33.3% (44)	10.01	2	.007**	.018
Dementia	132	0.7% (2)	2.8% (3)	**96.2% (127)**	481.80	2	.000**	.475
Diabetes	127	24.2% (71)	22.9% (25)	23.5% (31)	0.08	2	$.960^{NS}$	.000
Osteoarthritis	117	24.6% (72)	20.2% (22)	17.4% (23)	2.96	2	$.228^{NS}$	.005
Atrial fibrillation	107	18.4% (54)	26.6% (29)	18.2% (24)	3.69	2	$.158^{NS}$	.006
Visual impairment	89	16.4% (48)	20.2% (22)	14.4% (19)	1.48	2	$.477^{NS}$	.002
Ictus	85	13.0% (38)	17.4% (19)	21.2% (28)	4.85	2	$.088^{NS}$	.009
Chronic renal failure	83	14.7% (43)	18.3% (20)	15.2% (20)	0.84	2	$.658^{NS}$	.002
COPD	82	16.0% (47)	19.3% (21)	10.6% (14)	3.68	2	$.159^{NS}$	.006
Cancer	72	12.3% (36)	17.4% (19)	12.9% (17)	1.86	2	$.395^{NS}$	.004
Multiple falls	62	10.9% (32)	15.6% (17)	9.8% (13)	2.22	2	$.329^{NS}$	.004
Anemia	61	10.9% (32)	13.8% (15)	10.6% (14)	0.75	2	$.688^{NS}$	.001
Osteoporosis	58	12.3% (36)	11.0% (12)	7.6% (10)	2.09	2	$.352^{NS}$	.004
Peripheral vascular disease	56	10.6% (31)	7.3% (8)	12.9% (17)	1.96	2	$.376^{NS}$	.004
Ischemic heart disease	46	7.8% (23)	11.0% (12)	8.3% (11)	1.02	2	$.599^{NS}$	.002
Prior hip fracture	38	6.1% (18)	11.9% (13)	5.3% (7)	4.89	2	$.087^{NS}$	.009
Parkinson's disease	28	**3.1% (9)**	9.2% (10)	6.8% (9)	6.83	2	.033*	.013
Dysphagia					–	–	–	–
Aortic stenosis					–	–	–	–

Note. Bold numbers determine the most significant contribution. COPD = chronic obstructive pulmonary disease; *df* = degrees of freedom; ^{NS} = nonstatistically significantly different with $p > .05$.

[a]Chi-square test (χ^2) was applied.

*$p < .05$.

**$p < .01$.

Table 2 Baseline Pharmacological Treatments of Older Adults with Hip Fracture by Cognitive Impairment Levels

		Cognitive Impairment Levels						
Pharmacological Treatments	*n*	(*n* = 293) No Impairment	(*n* = 109) Mild	(*n* = 132) Moderate/Severe	χ^2	*df*	p^a	Effect Size R^2
Antihypertensives	390	74.1% (217)	**82.6% (90)**	**62.9% (83)**	12.10	2	.002**	.022
Benzodiazepines	189	30.7% (90)	44.0% (48)	38.6% (51)	6.97	2	.031*	.013
Antidepressants	171	**24.6% (72)**	39.4% (43)	42.4% (56)	16.79	2	.000**	.031
Proton pump inhibitors	157	28.7% (84)	28.4% (31)	31.8% (42)	0.50	2	.780^{NS}	.009
Antiplatelets	150	23.9% (80)	26.6% (29)	**38.6% (51)**	9.95	2	.007**	.018
Anticoagulants	100	17.4% (51)	24.8% (27)	16.7% (22)	3.32	2	.190^{NS}	.006
Oral antidiabetic agents	96	18.1% (53)	15.6% (17)	19.7% (26)	0.69	2	.710^{NS}	.002
Analgesics	94	16.7% (49)	22.9% (25)	15.2% (20)	2.84	2	.242^{NS}	.005
Antidementia	63	0%	0%	**47.7% (63)**	217.53	2	.000**	.290
Neuroleptics	52	**3.4% (10)**	12.8% (14)	**21.2% (28)**	34.30	2	.000**	.061
Antiosteoporosis	44	9.6% (28)	7.3% (8)	6.1% (8)	1.62	2	.445^{NS}	.003
Bronchodilators	40	7.8% (23)	9.2% (10)	5.3% (7)	1.41	2	.494^{NS}	.003
Domiciliary oxygen	28	5.1% (15)	7.3% (8)	3.8% (5)	1.54	2	.464^{NS}	.003
Antiparkinsonians	28	**2.7% (8)**	10.1% (11)	6.8% (9)	9.54	2	.008**	.017
Insulin	24	4.8% (14)	5.5% (6)	3.0% (4)	0.97	2	.615^{NS}	.002

Note. Bold numbers determine the most significant contribution. *df* = degrees of freedom; ^{NS} = nonstatistically significantly different with $p > .05$.
[a]Chi-square test (χ^2) was applied.
*$p < .05$.
**$p < .01$.

Hospital Discharge by Cognitive Impairment Level

With regard to features at hospital discharge (Table 4), statistically significant differences between cognitive impairment levels were shown for destination ($\chi^2 = 59.33$, $p < .001$, $R^2 = .107$), home discharge ($\chi^2 = 9.80$, $p = .044$, $R^2 = .019$), and ambulation capacity ($\chi^2 = 53.01$, $p < .001$, $R^2 = .096$) of older adults with hip fracture. The most frequent destinations of older adults with hip fracture at hospital discharge were concerted care centers for the mild cognitive impairment level group, nursing homes for the moderate/severe cognitive impairment level group, and their

Table 3 Complications of Older Adults with Hip Fracture by Cognitive Impairment Levels

		Cognitive Impairment Levels						
Outcomes	*n*	(*n* = 293) No Impairment	(*n* = 109) Mild	(*n* = 132) Moderate/Severe	χ^2	*df*	p^a	Effect Size R^2
Anemia	469	88.1% (258)	90.8% (99)	84.8% (112)	2.03	2	.363^{NS}	.004
Transfusion	208	38.2% (112)	44.0% (48)	36.4% (48)	1.62	2	.444^{NS}	.003
Delirium	196	**29.0% (85)**	43.1% (47)	48.5% (64)	17.28	2	.000**	.031
Constipation	117	23.9% (70)	28.4% (31)	**12.1% (16)**	10.78	2	.005**	.020
Renal function alteration	94	16.7% (49)	22.0% (24)	15.9% (21)	1.88	2	.390^{NS}	.004
Urinary tract infection	81	13.3% (39)	16.5% (18)	18.2% (24)	1.87	2	.392^{NS}	.004
Infection/respiratory insufficiency	79	11.6% (34)	**25.7% (28)**	12.9% (17)	13.01	2	.001**	.024
Malnutrition	74	12.3% (36)	20.2% (22)	12.1% (16)	4.59	2	.101^{NS}	.008
Heart failure	64	11.6% (34)	15.6% (17)	9.8% (13)	1.96	2	.375^{NS}	.004
Acute retention of urine	50	8.2% (24)	11.9% (13)	9.8% (13)	1.36	2	.508^{NS}	.002
Ischemic heart disease	39	7.2% (21)	3.7% (4)	10.6% (14)	4.26	2	.119^{NS}	.008
Death	31	5.1% (15)	10.1% (11)	3.8% (5)	4.90	2	.086^{NS}	.009
Pressure ulcers	21	5.1% (15)	2.8% (3)	2.3% (3)	2.46	2	.293^{NS}	.005
Seroma	9	2.4% (7)	0.9% (1)	0.8% (1)	–	–	–	–
Surgical wound infection	4	1.0% (3)	0%	0.8% (1)	–	–	–	–
Ictus	3	0.3% (1)	0.9% (1)	0.8% (1)	–	–	–	–
Venous thrombosis/ thromboembolism	2	0.3% (1)	0%	0.8% (1)	–	–	–	–

Note. Bold numbers determine the most significant contribution. *df* = degrees of freedom; ^{NS} = non statistically significantly different with $p > .05$.
[a]Chi-square test (χ^2) was applied.
*$p < .05$.
**$p < .01$.

Table 4 Features at Hospital Discharge of Older Adults with Hip Fracture by Cognitive Impairment Levels

		Cognitive Impairment Levels						
Outcomes	*n*	(*n* = 293) No Impairment	(*n* = 109) Mild	(*n* = 132) Moderate/Severe	χ^2	*df*	*p*[a]	Effect Size R^2
Destination	Concerted care center	32.0% (87)	**40.2% (39)**	25.6% (32)				
	Nursing home	22.1% (60)	24.7% (24)	**56.0% (70)**	59.33	6	.000**	.107
	Family home	21.3% (58)	21.6% (21)	**12.8% (16)**				
	Own home	**24.6% (67)**	13.4% (13)	5.6% (7)				
Home discharge	Yes	**12.5% (34)**	5.2% (5)	7.9% (10)				
	No	56.0% (153)	55.2% (53)	**66.7% (84)**	9.80	4	.044*	.019
	Hospital concerted center	31.5% (86)	39.6% (38)	25.4% (32)				
Ambulation	Independence/1 stick	1.1% (3)	0%	0%	53.01	6	.000**	.096
	Walker/2 sticks	**44.5% (122)**	22.7% (22)	13.5% (17)				
	High assistance	24.5% (67)	28.9% (28)	26.2% (33)				
	No possibility to walk	**29.9% (82)**	48.5% (47)	**60.3% (76)**				
Discharge	Yes	11.7% (32)	11.3% (11)	18.3% (23)	3.63	2	.163[NS]	.007

Note. Bold numbers determine the most significant contribution. *df* = degrees of freedom; [NS] = nonstatistically significantly different with $p > .05$.
[a]Chi-square test (χ^2) was applied.
*$p < .05$.
**$p < .01$.

own homes for the group without cognitive impairment. Home move was more common in older adults with no impairment, whereas no-move home was more frequent in the moderate/severe cognitive impairment level group. Ambulation assistance with a walker or two sticks was more frequent in the no-impairment cognitive group, whereas walking incapacity was more common in the moderate/severe cognitive impairment level group and less frequent in the no-impairment cognitive group. The rest of measurements did not show any statistically significant differences ($p > .05$, $R^2 = .002–.009$).

Discussion

This is the first study to support novel evidence about the influence of the cognitive impairment levels on baseline characteristics, comorbidity, complications, and pharmacological treatment in older adults over 75 years with hip fracture. The key points of cognitive impairment features may be used as a reference in the aging process of older adults with hip fracture. Indeed, the descriptive data of this sample may be considered representative from the Spanish population (Azagra et al., 2014).

Prior studies about gender differences (Gruber-Baldini et al., 2017), preoperative malnutrition and risk factors for postoperative delirium (Mazzola et al., 2017; Yang et al., 2017), delirium motor subtype profiles (Scholtens et al., 2017), mortality and dementia (Lee et al., 2017), perioperative delirium and dementia (Silverstein & Deiner, 2013), or mobility recovery (Ariza-Vega et al., 2017) have focused on cognitive impairment in older adults with hip fracture. Nevertheless, to date, no study was focused on cognitive impairment levels such as no impairment, mild impairment, moderate impairment, and severe impairment, according to the DSM-V (Ariza-Vega et al., 2017; Silverstein & Deiner, 2013).

With regard to the descriptive data by cognitive status level, decreased length of stay before surgery was shown for the no-impairment cognitive group. The length of hospital stay in conjunction with cognitive impairment may be stated as predictors of mobility after 3 months of hip fracture surgery (Ariza-Vega et al., 2017). Shortening of hospital stays may be beneficial to older adult patients to receive surgical intervention as early as possible (Rai, Varma, & Wani, 2017; Sobolev et al., 2017). Ariza-Vega et al. (2017) showed an increase in the Tinetti Performance-Oriented Mobility Assessment score from discharge to 3 months in older adults after hip fracture surgery. All cognitive impairment levels assessed by the Pfeiffers' Scale (Short Portable Mental State Questionnaire) were negatively associated with gait and balance, older age, weight bearing, length of hospital stay, and postsurgical complications. Although our study did not use these scales and 3 months of follow-up, shorter hospital length of stay before surgery was shown for the no-impairment level with respect to the mild cognitive impairment level.

Several differences of pharmacological treatment among elderly patients with hip fracture are shown with regard to the cognitive status level. Despite the obvious more common cognitive impairment medication use, antihypertensives, antiplatelets, and antidementia medication use was more frequent among older adults with cognitive impairment. This may be secondary to the decreased mobility of cognitive impaired older adults after hip fracture (Ariza-Vega et al., 2017).

Delirium was less common in the group without cognitive impairment, whereas constipation and infection or

respiratory insufficiency seemed to be more frequent among cognitive impaired older adults with hip fracture. Prior studies have shown that elderly patients with preoperative cognitive impairment may be more likely to develop postoperative delirium (Yang et al., 2017). Furthermore, complications may be associated wtih the reduced mobility of older adults with hip fracture and cognitive impairment (Ariza-Vega et al., 2017). Dementia may be defined as a syndrome secondary to disease of the brain, which is commonly chronic or progressive in nature. It may comprise impairment of several higher cortical functions, such as memory, thinking, comprehension, calculation, learning, language, and judgement, as well as generate changes in emotional control, social behavior, or motivation (Dening & Sandilyan, 2015). According to this definition, the most significant difference was found for the presence of dementia in the moderate and severe cognitive impairment group.

Older adults with hip fracture showed different characteristics at hospital discharge according to their cognitive impairment level. Activities to maintain and restore function in cognitive impaired elderly with hip fracture should be implemented after completion of active rehabilitation program and return home (van Wyk et al., 2014).

Relevance to Rehabilitation Nursing

Relevance for nursing`s clinical practice focuses on the quality of patient care outcomes, which are directly related to nursing. Nurses may consider the key points of cognitive impairment features as a main reference in the aging process of older adults with hip fracture. Nurses should be able to identify the patients' cognitive impairment level. Nurses must ensure the evaluation and reevaluation of cognitive impairment. Rehabilitation nursing comprises the role to assist in the clinical management of hospitalized patients (Blackburn et al., 2016). Physical, cognitive, and social status assessment prior to hip fracture must be the focus of an individual intervention plan due to its prognostic value. Multidisciplinary interventions with continuous monitoring should be implemented in order to prevent and treat complications as early as possible (Pareja Sierra et al., 2017).

With regard to the relevance for nursing's education, identification of the risk factors such as cognitive impairment for hip fracture in skilled nursing facility residents may permit to develop an osteoporosis screening and intervention (Colón-Emeric, Biggs, Schenck, & Lyles, 2003). Nursing outpatient evaluation should include a focused history with an emphasis on cognitive impairment level in conjunction with medications, complications, and comorbidities, as well as a physical examination, postural control, and overall physical function assessments in older adults with hip fracture (Fuller, 2000).

Considering the relevance for nursing's care management, community-based rehabilitation nursing posthospital discharge managements may improve physical function outcome measurements, mobility, and daily life activities for cognitive impaired older adults with hip fracture. Currently, a lack of outpatient rehabilitation nursing interventions targeted toward cognitive impaired older adults with hip fracture has been stated and highlighted (Chu et al., 2016).

With respect to practice, education, and management guidelines for rehabilitation nursing (Chu et al., 2016), this study may provide relevant information based on the cognitive impairment level and the characteristics, comorbidities, baseline pharmacological treatments, and complications of older adults who suffer from hip fracture. Indeed, older adults with hip fracture with moderate/severe cognitive impairment are more likely to be discharged to a nursing home, whereas those without cognitive impairment are more likely to go home. An integrated care pathway during the first weeks back at nursing homes should be developed regarding the quality of the transfer, pain management measures in the first month, and return to walking (Killington, Walker, & Crotty, 2016). Furthermore, our study supports that rehabilitation nursing programs should be adapted for patients with moderate/severe cognitive impairment in nursing homes. The domiciliary rehabilitation and support programs may be a safe and cost-effective method for older adults suffering from hip fracture (Sikorski & Senior, 1993). According to our results, these domiciliary rehabilitation nursing programs may be directed to older adults with higher cognitive capacities, such as better memory, thinking, comprehension, calculation, learning, language, judgment, or motor behavior.

Limitations

Several limitations should be considered for future studies about cognitive impairments in older adults with hip fracture. Although an orthogeriatric medical diagnosis was performed according to the DSM-V (Ariza-Vega et al., 2017; Silverstein & Deiner, 2013) and mild or moderate/severe cognitive impairment levels were categorized according to a psychiatrist medical diagnosis, the scores of cognitive measurements were not collected. The time frame for data registry only comprised from the hospitalization to the hospital discharge, and the data cleaning, reliability testing, validation of data extraction, management of missing data, or medical errors (medications, surgical procedures) were not considered in the present study. After hospital discharge, the follow-up, rehabilitation effectiveness,

Key Practice Points

- Nurses may use the key points of cognitive impairment features as a reference in the aging process of older adults with hip fracture.
- Nurses should be able to identify the level of the cognitive impaired older adults with hip fracture.
- Nurses must ensure that all patients are assessed and reassessed of cognitive impairment.
- Nurses have the responsibility to develop, implement, and evaluate a comprehensive care plan to assist in the clinical management of hospitalized patients.

complications, and pharmacological interventions should be registered. Indeed, new rehabilitation modalities for older adults with hip fracture need to be correlated with the cognitive impairment levels (Ariza-Vega et al., 2017; Thingstad et al., 2016).

Conclusions

Cognitive impairment levels may determine the characteristics, comorbidities, baseline pharmacological treatments, and complications of older adults who suffer from hip fracture. Nurses should identify the patients who present a specific cognitive impairment level during the rehabilitation process.

Conflicts of Interest

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