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ORIGINAL ARTICLE

Demographic, functional and clinical characteristics in hip fracture patients according to mental status of Spanish National Hip Fracture Registry

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ABSTRACT

Objective: To describe the differences according to mental status at admission on the care process and 30-day outcomes in hip fracture patients, mainly regarding the use of rehabilitation resources and anti-osteoporotic medication, by analysing data from the Spanish National Hip Fracture Registry (RNFC, "Registro Nacional de Fracturas de Cadera" in Spanish).
Methods: We analysed prospectively collected data from a cohort of patients admitted participating in the Spanish National Hip Fracture Registry (RNFC) in 76 Spanish hospitals between 2017 and 2019. We classified participants using Short Portable Mental Status Questionnaire (SPMSQ), defining two groups: patients with ≤2 SPMSQ score and patients with >2 SPMSQ score.
Results: Of 21,254 patients was recorded SPMSQ in 17,242 patients, 9052 were >2 SPMSQ score (52.6%). These were older (87.7 vs. 85.3 years; $p < 0.001$), had worse mobility (no-independent walking ability 26.0% vs. 4.5%; $p < 0.001$) and were more likely to be living in nursing homes (35.3% vs. 9.6%; $p < 0.001$). They were more likely to be treated nonoperatively (3.8% vs. 1.5%; $p > 0.001$), less early mobilisation (57.5% vs. 68.9%; $p < 0.001$) and suffered higher in-hospital mortality (5.2% vs. 2.7%; $p < 0.001$). At discharge, they received less anti-osteoporotic medication (37.9% vs. 48.9%; $p < 0.001$) and returned home less often (29.8%% vs. 51.2%; $p < 0.001$). One month after fracture, patients with >2 SPMSQ score had poorer mobility (no-independent walking ability 44.4% vs. 24.9%; $p < 0.001$) and were newly institutionalised in a nursing home more (12.6% vs. 12.0%; $p < 0.001$) and were more likely to die by one-month post-fracture (9.5% vs. 4.6%; $p < 0.001$).
Conclusion: RNFC patients with >2 SPMSQ score were more vulnerable and had poorer outcomes than patients with ≤2 SPMSQ score, suggesting that they need specialised care in-hospital and in the recovery phase.

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[1] See http://rnfc.es/wp-content/uploads/2019/12/Organigrama-RNFC_1.pdf.

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Palabras clave:
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Características demográficas, funcionales y clínicas de los pacientes con fractura de cadera según el estado cognitivo del registro nacional de fractura de cadera

R E S U M E N

Objetivo: Describir las diferencias al ingreso, durante el proceso asistencial y a los 30 días del alta, en el paciente con fractura de cadera según el estado cognitivo al ingreso, principalmente en el uso de recursos rehabilitadores y tratamiento antiosteoporótico, mediante el análisis de datos del Registro Nacional de Fractura de Cadera (RNFC).

Método: Analizamos los datos recogidos prospectivamente de la cohorte de pacientes que participaron en el RNFC en 76 hospitales españoles entre los años 2017 y 2019. Clasificamos a los participantes mediante el Short Portable Mental Status Questionnaire (SPMSQ), definiendo 2 grupos: pacientes con puntuación $\leq$2 SPMSQ y >2 SPMSQ.

Resultados: De 21.254 pacientes se registró el SPMSQ, en 17.242 pacientes, 9.052 tuvieron una puntuación >2 SPMSQ (52,6%). Estos eran mayores (87,7 frente a 85,3 años; p < 0,001), tenían peor movilidad (sin capacidad para caminar de forma independiente 26,0 frente al 4,5%; p < 0,001) y tenían más probabilidades de vivir en residencia (35,3 frente al 9,6%); p < 0,001). Tenían más probabilidades de recibir tratamiento conservador (3,8 frente al 1,5%; p > 0,001), menor movilización temprana (57,5 frente al 68,9%; p < 0,001) y sufrieron mayor mortalidad hospitalaria (5,2 frente al 2,7%; p < 0,.001). Al alta, recibieron menos tratamiento antiosteoporótico (37,9 frente al 48,9%; p < 0,001) y regresaron a domicilio con menor frecuencia (29,8 frente al 51,2%; p < 0,001). Un mes después de la fractura, los pacientes con puntuación SPMSQ > 2 tenían peor movilidad (sin capacidad para caminar de forma independiente 44,4 frente al 24,9%; p < 0,001) y fueron institucionalizados recientemente en residencia con mayor frecuencia (12,6 frente al 12,0%; p < 0,001), y tenían mayor probabilidad de fallecer al mes de la fractura (9,5 frente al 4,6%; p < 0,001).

Conclusión: Los pacientes del RNFC con puntuación en el SPMSQ > 2 fueron más vulnerables y tuvieron peores resultados que los pacientes con una puntuación en el SPMSQ $\leq$ 2, lo que sugiere que necesitan atención especializada tanto en el hospital como en la fase de rehabilitación.

Introduction

People with cognitively impaired are up to three times more likely to sustain a hip fracture than cognitively intact older adults, due to an increased risk of osteoporosis, frailty, and falls.[1] The estimated prevalence of hip fracture patients with cognitive impairment was 20–45% according to geographical region and diagnostic criteria.[2] It presents a challenge to healthcare system which must respond to their specific needs such as a high dependency, mortality, and use of rehabilitative resources.

Incidence rate of cognitive impairment increases exponentially from the age of 65 onwards, and the proportion of women affected increases in older age groups. The number of individuals with cognitive impairment is predicted to triple worldwide by 2050, from 55.2 million to 130 million.[3] The prevalence of cognitive impairment in Spain has been estimated at 45% in community-dwelling adults older than 85 years.[4]

There are few Spanish studies that analyses baseline intrahospital and follow-up differences according to cognitive status. In addition, these are small studies and use different diagnostic tool. In the first published studies,[5,6] a relationship was found between mental status and functional recovery, mortality, and institutionalisation. Subsequently, studies focused on patients with cognitive impairment have emerged,[7,8] which also point out differences between the different degrees of cognitive impairment.

In the last years the interest of cognitive impairment impact has increased along with the creation of international hip fracture registries, but in Spain there are very few local studies describing these differences at baseline, during hospitalisation and at follow-up according to their cognitive status.

The aim of these study is to determine the differences according to mental status at admission on their care process and outcomes, mainly regarding the use of rehabilitation resources and anti-osteoporotic medication, by analysing data from the Spanish National Hip Fracture Registry (RNFC, "Registro Nacional de Fracturas de Cadera").

Methods

The RNFC is a multicentre, observational study of patients admitted with hip fracture. This national registry started in 2017 from the participating voluntary hospitals, most of them included in the National Health Service Network, and it represents 30% of all regions nationally. The inclusion criteria was: having been admitted to one of the participating hospitals with the diagnosis of hip fracture due to fragility (due to a fall from standing height), being older than 74 years of age (75 years or older) and understanding and signing an informed consent (by the patient or their next of kin). The exclusion criterion was any hip fracture occurring as a result of high energy trauma as well as pathologic fractures due to cancer.

Data collection took place in two phases. In the hospital phase, the data corresponding to baseline status and those referring to the process until the time of discharge will be collected by the physician in charge of the patient. In the post-discharge phase, data was collected one month after the fracture by telephone interview or at a follow-up visit by a team member.[9] The following variables were analysed: (1) Data on admission: demographics (age and sex), place of residence (own home or institution), mental status (Short Portable Mental State Questionnaire; SPMSQ), anaesthetic risk (ASA risk score; American Society of Anaesthesiologists), mobility (FAC; Functional Ambulation Categories), pre-fracture anti-osteoporotic medication and type of fracture; (2) Data during hospitalisation: surgical treatment, time to surgery, type of anaesthesia, use of peripheral nerve blocks, early mobilisation (mobilisation on the first postoperative day), development of at least grade II pressure ulcers during hospitalisation, and in-hospital mortality; (3) Data at discharge: length of hospital stay, prescription of

anti-osteoporotic medication and destination at discharge; and (4) Follow-up at 30 days post-fracture: mortality, place of residence, mobility, anti-osteoporotic medication and fracture-related hospital readmissions.

Cognitive status was assessed at admission using the screening scale SPMSQ with 10 questions and scores between 0 and 10 errors, validated in Spanish by Martínez de la Iglesia et al.[10] The evaluation was performed at the situation closest to the patient's baseline, and if in doubt, repeated twice, choosing the result with the best score. We classified participants defining two groups: patients with ≤2 SPMSQ score and patients with >2 SPMSQ score.[11–13]

Mobility (walking ability) was assessed using the FAC scale, with values between 0 and 5; 0 (not walking or needing help from two people), 1 (walking with full help from one person), 2 (walking with partial help from one person), 3 (walking with supervision from one person), 4 (independent walking on level ground, but needing help to negotiate stairs), and 5 (independent walking on level ground and stairs). The variable "change in walking ability" was created by comparing baseline mobility with mobility 30 days post-fracture, and was classified into two categories: category 1 (functional loss from previous independent walking ability) when changing from FAC 4–5 to FAC 0–3; category 2 (recovery or maintenance of previous independent walking ability) when changing from FAC 4–5 to FAC 4–5; other category included: category 3 (recovery or maintenance of previous independent walking ability) when changing from FAC 4–5 to FAC 4–5 and category 4 (functional gain, recovery of non-independent walking ability) when changing from FAC 0–3 to FAC 4–5.

For this study we analysed patients included between 2017 and 2019. Quantitative variables were described using means and standard deviations if normally distributed and with median values and interquartile ranges (IQR) if not; qualitative variables were described through absolute and relative frequencies. Adjustment to normality was checked by graphical methods. A bivariate analysis was performed comparing mental status and the demographic and clinical characteristics of the patients, time to surgery and hospital stay, mortality, location at discharge and mobility at follow-up. Student's *t*-test or Mann–Whitney's *U* test was used to compare dichotomous qualitative variables with quantitative variables, and the Chi-square test to measure the association of two qualitative variables. In all cases, statistical significance was set at a 95% confidence interval ($p < 0.05$). Data were analysed using the SPSS 24.0 statistical package (IBM, Armonk, NY, USA).

Results

A total of 21,254 patients were included on the RNFC during the study period. The mean age was 86.7 ± 5.6 years, 75.6% were female and 24.1% lived in a nursing home. Intertrochanteric fractures were the most common fracture type (51.8%), and 97.1% of patients underwent surgery after an average of 79.0 h (95% CI 27.6–94.1 h), with a median length of stay of 10.4 days (95% CI 6.6–12.8 days). Demographic, clinical, management and follow-up characteristics as well as the percentage of lost cases for each variable are shown in Table 1. SPMSQ score was recorded in 81.1% of patients, leaving a valid study sample of 17,242 patients. The mean score was 3.7 score (3.4 DS) with 8190 patients (47.4%) with 0–2 SPMSQ score and 9052 patients (52.6%) with more than 2 SPMSQ score; 20.2% (3491 patients) had more than 8 SPMSQ score.

Pre-fracture characteristics

Demographic, clinical, and functional differences between hip fracture patients according SPMSQ score are shown in Table 2. Patients with >2 SPMSQ score were older (87.7 vs. 85.3 years; $p < 0.001$), had less independent walking ability (FAC 4–5) (45.6% vs. 75.1%; $p < 0.001$), higher anaesthetic risk (77.8% vs. 63.5%; $p < 0.001$), were more likely to live in a nursing home (35.3% vs. 9.6%; $p < 0.001$) and were received less anti-osteoporotic medication (37.9% vs. 48.9%; $p > 0.001$), compared to those who were ≤2 SPMSQ score. Patients from nursing homes had twice as many cases with >2 SPMSQ score as those living in the community (80.3% vs. 44.1%; $p < 0.001$).

Table 1
Overview of the characteristics of the 21,254 RNFC patients and missing data.

	Results	Missing data
Pre-fracture characteristics		
Age	86.7 (5.6)	4 (0.0)
Female gender	16,055 (75.5)	7 (0.0)
SPMSQ score		4011 (18.9)
0–2	8191 (47.5)	
3–4	2693 (15.7)	
5–7	2868 (16.6)	
8–10	3491 (20.2)	
ASA 3–5	14,465 (71.8)	1121 (5.2)
Independent walking ability (FAC 4–5)	15,568 (82.8)	419 (1.9)
Place of residence: nursing home	5085 (24.1)	172 (0.8)
Fracture type		66 (0.3)
Intracapsular non-displaced	2241 (10.6)	
Intracapsular displaced	6127 (28.9)	
Intertrochanteric	10,972 (51.8)	
Subtrochanteric	1608 (7.6)	
Other	240 (1.1)	
Anti-osteoporotic medication	1246 (5.9)	182 (0.8)
Clinical and care characteristics during admission		
Non-operative treatment	599 (2.9)	298 (1.4)
Type of anaesthesia		1252 (5.8)
Spinal anaesthesia	18,494 (92.5)	
General anaesthesia	1277 (6.4)	
Other	231 (1.1)	
Peripheral nerve block	2938 (17.5)	4434 (20.8)
Pressure ulcer grade II–IV	1253 (6.2)	888 (4.2)
Mobilisation on the first postoperative day	12,789 (62.0)	627 (3.0)
Anti-osteoporotic medication at discharge	8351 (41.6)	1202 (5.7)
Destination at discharge		116 (0.5)
Home	8254 (39.0)	
Nursing home (previous)	4366 (20.6)	
Nursing home (newly institutionalised)	2367 (11.1)	
GRU	4635 (21.9)	
Other	482 (2.2)	
In-hospital mortality	999 (4.7)	116 (0.5)
30-Day follow-up results		
Independent walking ability (FAC 4–5)	10,547 (41.3)	3277 (15.4)
Change in walking ability		3376 (15.8)
Category 1	5051 (28.2)	
Category 2	10,020 (56.0)	
Another category	2807 (15.7)	
Anti-osteoporotic medication	8223 (44.0)	2585 (12.2)
Destination		2988 (14.0)
Home	8923 (48.8)	
Nursing home (previous)	3966 (21.7)	
Nursing home (newly institutionalised)	2506 (13.7)	
GRU	2170 (11.8)	
Other	688 (3.7)	
Hip-related reoperation	435 (2.2)	1932 (9.1)
Mortality	1653 (8.5)	973 (4.6)

Data are expressed as a number (percentage), except for age, which is expressed as a mean (standard deviation).
ASA: American Society of Anaesthesiologists; FAC: Functional Ambulation Categories; GRU: geriatric rehabilitation unit; SPMSQ: Short Portable Mental Status Questionnaire.

Table 2
Differences in the 17,242 RNFC patients according SPMSQ score: baseline characteristics, in-hospital management, and outcomes at discharge and at 30 days.

	SMPSQ score ≤2 n = 8190 (47.4%)	SMPSQ score >2 n = 9052 (52.6%)	*p* value
Pre-fracture characteristics			
Age	85.3 ± 5.5	87.7 ± 5.4	<0.001
Female gender	5970 (72.9)	7077 (78.2)	<0.001
Place of residence: nursing home	786 (9.6)	3194 (35.3)	<0.001
Independent walking ability (FAC 4–5)	7821 (95.5)	6726 (74.0)	<0.001
ASA 3–5	5200 (63.5)	7040 (77.8)	<0.001
Intertrochanteric fracture	4119 (50.3)	4766 (52.7)	<0.001
Subtrochanteric fracture	687 (8.4)	576 (6.9)	<0.001
Anti-osteoporotic medication	557 (6.8)	480 (5.3)	<0.001
Clinical and care characteristics during admission			
Non-operative treatment	126 (1.5)	350 (3.8)	<0.001
Time to surgery (h), median (95% CI)	55.0 (28.5–94.0)	57.0 (28.5–93.9)	0.207
Length of stay (days), median ± IQR	8.9 (6.6–12.6)	8.9 (6.4–12.7)	0.720
Peripheral nerve block	1629 (19.9)	1481 (16.3)	<0.001
Spinal anaesthesia	7469 (91.9)	8380 (92.6)	<0.001
Pressure ulcer grade II–IV	327 (4.0)	670 (7.7)	<0.001
Mobilisation on the first postoperative day	5642 (68.9)	5226 (57.5)	<0.001
Anti-osteoporotic medication at discharge	4004 (48.9)	3445 (37.9)	<0.001
Destination at discharge			
Home	4223 (51.2)	2704 (29.8)	<0.001
Nursing home (previous)	663 (8.0)	2754 (28.9)	<0.001
Nursing home (newly institutionalised)	970 (11.8)	1068 (11.7)	<0.001
GRU	1916 (23.3)	1756 (19.3)	<0.001
Other	197 (2.4)	298 (3.2)	<0.001
In-hospital mortality	221 (2.7)	472 (5.2)	<0.001
30-Day follow-up results			
Independent walking ability (FAC 4–5)	6151 (75.1)	4106 (45.6)	<0.001
Change in walking ability			
Category 1	1625 (19.8)	2594 (28.6)	<0.001
Category 2	5459 (66.6)	3188 (35.2)	<0.001
Another category	1106 (13.6)	3270 (36.1)	<0.001
Anti-osteoporotic medication	4308 (52.6)	3536 (38.9)	<0.001
Destination			
Home	4718 (57.6)	2861 (31.6)	<0.001
Nursing home (previous)	618 (7.5)	2551 (28.1)	<0.001
Nursing home (newly institutionalised)	987 (12.0)	1146 (12.6)	<0.001
GRU	849 (10.3)	820 (9.0)	<0.001
Other	642 (7.8)	811 (8.9)	<0.001
Hip-related further surgery	165 (2.0)	180 (1.9)	<0.001
Mortality	376 (4.6)	863 (9.5)	<0.001

Data are expressed as number (percentage), or as mean standard deviation.
CI: confidence interval; ASA: American Society of Anaesthesiologists; FAC: Functional Ambulation Categories; GRU: geriatric rehabilitation unit; SPMSQ: Short Portable Mental Status Questionnaire.

Clinical and care characteristics during admission

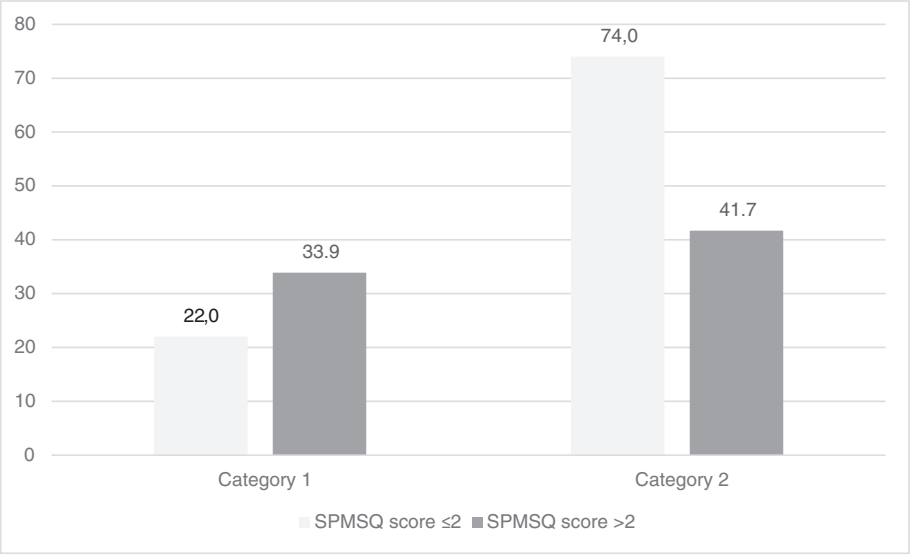
The differences between the two groups during the acute hospitalisation phase are shown in Table 2. Patients with >2 SPMSQ score were more likely to receive non-operative treatment (3.8% vs. 1.5%; $p < 0.001$), and of those treated surgically, less were mobilised on the first postoperative day (57.5% vs. 68.9%; $p < 0.001$); patients with >2 SPMSQ score also developed more pressure ulcers (7.7% vs. 4.0%; $p < 0.001$) and suffered higher in-hospital mortality (5.2% vs. 2.7%; $p < 0.001$). No differences were found regarding time to surgery and length of stay. At discharge, they were prescribed less anti-osteoporotic medication (37.9% vs. 48.9%; $p < 0.001$) and were less frequently transferred to geriatric rehabilitation units (GRU) (19.3% vs. 23.3%; $p < 0.001$). They also returned home less frequently (29.8% vs. 51.2%; $p < 0.001$).

30-Day follow-up results

Information at 30-day follow-up in both groups is shown in Table 2. Information on complications related to surgery is collected, requiring more frequent surgical reintervention patients with ≤2 SPMSQ score (2.0% vs. 1.9%; $p < 0.001$). One-month mortality was higher among patients with >2 SPMSQ score (9.5% vs. 4.6%; $p < 0.001$). Regarding mobility at 30 days, Fig. 1 shows that patients with >2 SPMSQ score had worse functional recovery (category 1) than those patients with ≤2 SPMSQ score (33.9% vs. 22.0%; $p < 0.001$). Patients with >2 SPMSQ score able to walk independently at baseline (category 2) maintained or recovered their previous situation less frequently.

Discussion

In this multicentre cohort study, we observed that individuals with >2 SPMSQ score were older, more likely to live at nursing home and presented a higher surgical risk compared to patients with ≤2 SPMSQ score. Furthermore, they did not receive the same intensity of medical, surgical or rehabilitation treatment. Patients with >2 SPMSQ score received more non-operative treatment, were less frequently transferred to geriatric rehabilitation units, and



a) *Category 1*: change from FAC 4-5 to FAC 0-3; Functional loss vs. previous independent walking ability.

b) *Category 2:* change from FAC 4-5 to FAC 4-5; Recovery or maintenance of previous independent walking ability.

c) FAC: Functional Ambulation Categories

Fig. 1. Differences in the 17,242 RNFC patients with a change in mobility status at 30-day follow-up, among two groups according to SPMSQ score. *Category 1*: change from FAC 4–5 to FAC 0–3; functional loss vs. previous independent walking ability. *Category 2*: change from FAC 4–5 to FAC 4–5; recovery or maintenance of previous independent walking ability. FAC: Functional Ambulation Categories.

were prescribed less anti-osteoporotic medication. Non-recovery of independent walking ability was more common, with higher in-hospital and one-month mortality in this group. These findings are providing new information concerning the treatment and follow-up of people with cognitively impaired cognitive and hip fracture. We explain some of the characteristics studied in more detail.

Pre-fracture characteristics

Firstly, we would like to stress the *proportion of patients with >2 SPMSQ score*, over half of the sample. In fact, in patients hospitalised for hip fracture, it is recommended by different clinical practice guidelines[14,15] to carry out a preoperative medical assessment, including a cognitive assessment, although they do not usually comment how this is to be performed. Other international registers report a decline in mental status between 26% and 39%, using the Abbreviated Mental Test (AMT) screening test, with a cut-off for cognitive impairment of >6 out of 10 correct scores.[16] Although in the Italian registry used SPMSQ, with 50% using the same cut-off point >2 out of 10 errors, like our study.[11]

Additionally, people with cognitive impairment are older, have more risk factors for falls associated with gait disorders, instability, sarcopenia, as well as bone fragility due to osteoporosis. Our results are consistent with these facts (older patients with worse previous functional status), so is important more efforts towards strategies to study and reduce the risk of falls and to improve the prescription of anti-osteoporotic.

Clinical and care characteristics during admission

The results of this study suggest that hip fracture patients with >2 SPMSQ score are more likely be *managed conservatively*, despite the recommendations of clinical practice guidelines of not performing surgery exceptionally in: patients with a very short life expectancy who will not receive any benefit of surgery, or the risk is greater with a surgical intervention; patients with subacute hip fractures with signs of consolidation, and patients unwilling to undergo surgery. Ethical implications may arise, as different studies,[17] show that patients managed nonoperatively have worse results in terms of hospital stay, delayed weight bearing, increased risk of fracture displacement, worse satisfaction, greater functional and cognitive decline, and higher mortality.

On the other side, patients treated surgically are *mobilised later* compared to patients with <2 SPMSQ score. Analysis of the National Hip Fracture Database and hospital records for 126,897 patients in the United Kingdom's National Hip Fracture Database by Goubar et al.[18] show that patients with cognitive impairment were less likely to mobilise early despite observed associations with survival and ambulation recovery for those with and without cognitive impairment. However, they also have a higher prevalence of pressure ulcers, and we cannot exclude the influence of other factors not analysed such as poorer nutritional status, presence of sarcopenia, intercurrent infectious, comorbidities, or delirium. The appearance of ulcers during the postoperative period has been shown to be a risk factor for further complications.[19]

Regarding *pain control and anaesthetic management*, there are evidence on the benefits of peripheral nerve blockade, which is recommended to be performed early; it has been shown to reduce the use of opiates, hospital stay, the risk of developing delirium and to favour returning home.[20] However, we found it to be used less frequently in patients with >2 SPMSQ score in our study. Although spinal anaesthesia has not been found to outperform general anaesthesia in terms of survival, functional recovery, and occurrence of delirium,[21] in our sample it was used more in patients with >2 SPMSQ score.

Also, the mental status influence on hospital length of stay and surgical delay is a matter of controversy. Authors such as Tomioka et al.[22] suggest that shorter stays may be associated with a more proactive attitude from healthcare professionals to prevent the onset of delirium during hospitalisation, thus favouring early

discharge. Other authors such as Mitchell et al.[23] suggest that coming from nursing home may favour early return.

30-Day follow-up results

Patients with cognitive impairment suffer more medical complications, including delirium, as well as *surgical complications*, with a greater risk of hip dislocation[24]; we observed greater readmission rates for fracture-related surgical complications.

Among the multiple factors associated with worse *functional recovery* one month after fracture are mental status, deteriorated baseline functional status, living in a nursing home and less early mobilisation, as observed in our study. The study by González de Villaumbrosia et al.[25] conducted on a large RNFC population, describes a predictive tool for functional recovery (HF-prognosis) that includes the SPMSQ score as a negative factor in recovery. In our study, the greatest functional recovery among both groups of patients was in those with better previous functional status, as shown in Fig. 1. The proven benefits of physical rehabilitation in patients with cognitive impairment guide us to facilitate admitting them to an appropriate rehabilitation resource. However, resources are limited and have a variable geographic distribution, as well as differing hospital organisation, patient characteristics, and caregiver preferences. Several studies have observed that patients with cognitive impairment were less likely to have access to rehabilitation resources and received lower-intensity rehabilitation, influencing not functional recovery but also the risk of readmission and mortality.[26] Considering these results, we suggest that referral to GRU should be more conditioned by the pre-fracture functional status, regardless of the patient's cognitive status.

Hip fracture is a serious and common problem for older *people living in nursing homes*, with a greater impact on morbidity and mortality compared community dwellers. Ríos-Germán et al.,[27] analysed a large sample of RNFC data and observed that those living in nursing homes were also more vulnerable: they were older, less independently mobile, had higher SPMSQ score and were managed very differently during hospitalisation and at discharge, with poorer outcomes and less use of rehabilitative resources. This was also observed in the Australian and New Zealand Hip Fracture Registry, where patients coming from nursing homes were less likely to receive rehabilitation, and the rehabilitation received varied depending on the presence of cognitive impairment and/or delirium.[24] The risk of new institutionalisation in patients with cognitively impaired suffering fractures was higher in our study. The Danish Multidisciplinary Hip Fracture Registry found that age, living alone and having cognitive impairment were the key factors for institutionalisation after fracture, independently of comorbidity.[28] Support in nursing homes by professionals from Orthogeriatric Units has been shown to improve mobility and quality of life and to reduce both mortality and readmission rates and could, therefore, be considered a valid alternative. The Norwegian Hip Fracture Register (NHFR) is one of the few registries that routinely collect patient reported outcome measures (PROMs) like pain/discomfort or anxiety/depression of EuroQol five dimension, from patients including cognitively impaired patients and reported lower health-related quality of life pre-fracture, at four and 12 months after the hip fracture.[29]

Although cognitively impaired patients fit the profile of those at high risk of new fractures (older patients, living in nursing homes, with a high risk of falls and a greater risk of imminent fracture after the first fracture), under-treatment in *primary and secondary prevention of osteoporosis* is still observed, increasing morbidity, mortality, and healthcare costs.[30] In the RNFC study by Alarcón et al.,[31] the prescription of anti-osteoporotic medication at discharge was 36.5% with a wide variability between hospitals. Patients with better functional and mental status were more likely to receive anti-osteoporotic medication after hip fracture. The implementation in recent years of the Fracture Liaison Services (FLS) could favour adherence to these treatments, although Moral-Cuesta et al.[32] observed that the inclusion of cognitively impaired patients in these programmes is lower. Decisions for initiating and continuing treatment should reflect a patient-centred approach incorporating life expectancy, goals of care, and the potential burden of treatment, not only mental status or living in nursing home. Possibly the under-treatment in these patients could be motivated to believe it has no health benefit or for adverse effects risk.[33] But there are studies had proven anti-osteoporosis medication was associated with similar trends in reduced risk of subsequent fracture in frail and non-frail persons.[34]

Most predictive models show that cognitive impairment is a risk factor for *mortality* in hip fracture patients. Hou et al.[35] showed a two-fold increase of mortality in patients with cognitive impairment compared to those without, in their meta-analysis by causes in the first 30 days post-surgery have been related to cardiovascular, respiratory, and cerebrovascular events. The Nottingham hip fracture score (NHFS) which predicts 30-day mortality and includes cognitive status among other items (age, place of residence and cognitive impairment using the AMT score).[36] The Danish Register analysed the excess mortality risk in patients with cognitive impairment and concluded that it could not be explained by clinical management factors such as time to surgery.[37] Other authors point out a possible connection with less access to rehabilitation resources,[26] the presence of behavioural disorders[38] or severity of cognitive impairment as shown in the study by Tarazona-Santalbina et al.,[8] with poorer functional and mortality outcomes at higher disease stages.

Among the limitations of the study is the fact that, being carried out at national and multicentre level, participating hospitals did not necessarily apply the same care protocol everywhere. Furthermore, we used a screening cognitive test, and the risk of misclassification with perioperative delirium. For this reason, since 2022 the RNFC use on preoperative and postoperative the 4 AT-ES to be able to detect not only the possible cognitive decline but also the presence of delirium.[39]

In conclusion, this study shows that the profile of patients with >2 SPMSQ score admitted for hip fracture are vulnerable patients and have a worse previous functional and mental status, and we found differences in terms of the model of care (later mobilisation, lower percentage of surgical treatment, less prescription anti-osteoporotic medication), and worse clinical results as well (higher mortality, worse functional recovery and more pressure injuries). These results guide us to implement measures on modifiable factors such as surgery, early mobilisation, secondary prevention of new fractures, rehabilitation, and quality multidisciplinary care to prevent complications and avoidable mortality.

Informed consent

subjects gave informed consent (patient or relatives).

Ethical approval

This research project was approved by the Ethics Committee of the Hospital Universitario La Paz, Madrid (IdiPAZ project number 2574) and was ratified by the review committees of all participating hospitals.

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Conflicts of interest

The authors declare that they have no conflicts of interest.

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