ORIGINAL

Received: May 15th 2019
Accepted: July 23rd 2019
Published: October 18th 2019

SPANISH NATIONAL HIP FRACTURE REGISTRY (RNFC): FIRST-YEAR RESULTS AND COMPARISON WITH OTHER REGISTRIES AND PROSPECTIVE MULTICENTRIC STUDIES FROM SPAIN(*)

Pilar Sáez-López (1,2), Cristina Ojeda-Thies (3), Teresa Alarcón (2,4), Angélica Muñoz Pascual (5), Jesús Mora-Fernández (6), Cristina González de Villaumbrosia (7), María Jesús Molina Hernández (8), Nuria Montero-Fernández (9), José Manuel Cancio Trujillo (10), Adolfo Díez Pérez (11,12), Daniel Prieto Alhambra (13, 14), José Ramón Caeiro Rey (15), Íñigo Etxebarria Foronda (16), Paloma Gómez Campelo (2,17), Teresa Pareja Sierra (18), Francisco José Tarazona-Santabalbina (19, 20), Rosario López-Giménez (21), Ángel Otero Puime (21), Laura Navarro-Castellanos (2), Rocío Queipo Matas (22), Sonia Jiménez Mola (23), Tomás López-Peña (24), Concepción Cassinello Ogea (25) and Juan I. González-Montalvo (2,4) representing the participants of the RNFC

(1) Unidad de Geriatría. Hospital Universitario Fundación Alcorcón. Alcorcón. Spain.

(2) Instituto de Investigación del Hospital Universitario La Paz, "IdiPaz". Madrid. Spain.

(3) Servicio de Traumatología y Cirugía Ortopédica. Hospital Universitario 12 de Octubre. Madrid. Spain.

(4) Servicio de Geriatría. Hospital Universitario La Paz. Madrid. Spain.

(5) Sección de Geriatría. Complejo Asistencial de Segovia. Segovia. Spain.

(6) Servicio de Geriatría, IdISSC. Hospital Universitario Clínico San Carlos. Madrid. Spain.

(7) Servicio de Geriatría. Hospital Universitario Rey Juan Carlos. Móstoles. Spain.

(8) Servicio de Geriatría. Hospital Universitario Severo Ochoa. Leganés. Spain.

(9) Servicio de Geriatría. Instituto de Investigación Sanitaria Gregorio Marañón. Hospital Universitario Gregorio Marañón. Madrid. Spain.

(10) Centro Sociosanitario El Carme. Servicio de Geriatría y Cuidados Paliativos de BSA (Badalona Servicios Asistenciales). Badalona. Spain.

(11) Hospital del Mar y Universidad Autónoma de Barcelona. Barcelona. Spain.

(12) CIBER de Fragilidad y Envejecimiento Saludable (CIBERFES). Instituto Carlos III. Madrid. Spain.

(13) NDORMS, Grupo de Investigación GREMPAL, Idiap Jordi Gol y CIBERFes. University of Oxford. Oxford. United Kingdom.

(14) Universitat Autònoma de Barcelona e Instituto de Salud Carlos III. Barcelona. Spain.

(15) Servicio de Cirugía Ortopédica y Traumatología. Complejo Hospitalario Universitario de Santiago. Departamento de Cirugía. Universidad de Santiago de Compostela. Santiago de Compostela. Spain.

(16) Hospital Alto Deba. Arrasate/Mondragón. Spain.

(17) Centro de Ciencias de la Salud San Rafael. Universidad Antonio de Nebrija. Madrid. Spain.

(18) Servicio de Geriatría. Hospital Universitario de Guadalajara. Guadalajara. Spain.

(19) Servicio de Geriatría. Hospital Universitario de La Ribera. Alzira. Spain.

(20) Hamad Medical Corporation. Doha. Qatar.

(21) Departamento de Medicina Preventiva y Salud Pública. Universidad Autónoma de Madrid. Madrid. Spain.

(22) Universidad Europea de Madrid. Madrid. Spain.

(23) Servicio de Geriatría. Complejo Asistencial Universitario de León. León. Spain.

(24) Subdirección General de Programas Internacionales de Investigación y
Relaciones Institucionales. Instituto de Salud Carlos III. Madrid. Spain.

(25) Servicio de Anestesiología y Reanimación. Hospital Universitario Miguel Servet. Zaragoza. Spain.

Authors declare that there is no conflict of interest.

(*) Financing: The RNFC has been financed through donations by AMGEN SA, UCB Pharma, Abbott Laboratories and FAES Farma, as well as a Research Grant from the Fundación Mutua Madrileña (AP169672018). The sponsors did not influence any aspect of the project nor of the drafting of this manuscript.

Correspondence:
Pilar Sáez López
Unidad de Geriatría
Hospital Universitario Fundación Alcorcón
Calle Budapest, 1
28922 Alcorcón, Madrid
pisalop@gmail.com

Suggested citation: Sáez-López P, Ojeda-Thies C, Alarcón T, Muñoz Pascual A, Mora-Fernández J, González de Villaumbrosia C, Molina Hernández MJ, Montero-Fernández N, Cancio Trujillo JM, Díez Pérez A, Prieto Alhambra D, Caeiro Rey JR, Etxebarria Foronda I, Gómez Campelo P, Pareja Sierra T, Tarazona-Santabalbina FJ, López-Giménez R, Otero Puime A, Navarro-Castellanos L, Queipo Matas R, Jiménez Mola S, López-Peña T, Cassinello Ogea C, González-Montalvo JI. Spanish National Hip Fracture Registry (RNFC): first-year results and comparison with other registries and prospective multicentric studies from Spain. Rev Esp Salud Pública. 2019;93: October 18th e201910072.

ABSTRACT

Background: The Spanish National Hip Fracture Registry (Registro Nacional de Fracturas de Cadera or RNFC) is a Spanish, prospective, multi-centric registry, commenced in 2017. The goal of this paper is to present the data from the first annual report and to compare them with autonomic registries and recent prospective multi-centric studies performed in Spain.

Methods: We included persons 75 years of age or older treated for fragility hip fractures in any of the centers participating in the RNFC between January and October 2017. The descriptive statistics of each variable used the mean (and standard deviation) or the median (and interquartile ranges) for the ordinal variables and the percentage for the categoric variables. A descriptive analysis of the casemix was performed and compared with available data from the aforementioned studies.

Results: The RNFC included 7.208 patients from 54 hospitals, with a mean age of 86.7 (SD 5.6) years; 75.4% were women, and 36.4% showed cognitive decline. Mean surgical delay was 75.7 (SD 63.6) hours, and length of stay averaged 10.9 (SD 6.7) days. Of the patients who lived at home (75.4%), less than half (37.0%) returned home at discharge. One-month mortality was 7.1%. Comparison with other studies showed important differences, especially regarding patients newly sent to nursing homes (7.7-29.4%) and with anti-osteoporotic treatment at discharge (14.5-36.7%).

Conclusions: The RNFC is the largest prospective database to date that offers data regarding the characteristics of patients hospitalized for hip fractures in Spain. Comparison with recent studies showed some important differences.

Key words: Hip fractures, Osteoporosis, Registries, Elderly

RESUMEN

Registro Nacional de Fracturas de Cadera (RNFC): resultados del primer año y comparación con otros registros y estudios multicéntricos españoles.

Fundamentos: El Registro Nacional de Fracturas de Cadera (RNFC) es un registro español multicéntrico, prospectivo y continuo, que comenzó en 2017. El objetivo de este artículo fue presentar los datos del primer informe anual y compararlos con los registros autonómicos y los estudios multicéntricos realizados recientemente en España.

Métodos: Se incluyeron las personas de 75 años o más atendidas con el diagnóstico de fractura de cadera por fragilidad en alguno de los hospitales participantes en el RNFC, entre enero y octubre de 2017. En el análisis estadístico se utilizó la media y desviación estándar o mediana y rangos intercuartílicos para las variables numéricas y los porcentajes para las variables categóricas. Se realizó un análisis descriptivo global de la casuística y se comparó con los datos disponibles de los estudios previos mencionados.

Resultados: Se registraron 7.208 personas de 54 hospitales, con una edad media de 86,7 años (DE 5,6). El 75,4% fueron mujeres y el 36,4% presentaron deterioro cognitivo previo. La demora quirúrgica media fue de 75,7 horas (DE 63,6) y la estancia media fue de 10,9 días (DE 6,7). De las personas que vivían en un domicilio antes de la fractura (75,4%), menos de la mitad (37,0%) volvieron a él tras el alta hospitalaria. Al mes, había fallecido el 7,1%. La comparación con los otros estudios mostró algunas diferencias importantes, sobre todo en la ubicación previa, en el porcentaje de pacientes institucionalizados de novo (7,7-29,4%) y en el porcentaje con tratamiento antiosteoporótico al alta (14,5-36,7%).

Conclusiones: El RNFC es la mayor base de datos prospectiva que aporta datos sobre el perfil de los pacientes hospitalizados por fractura de cadera en España. La comparación con otros estudios recientes muestra algunas diferencias importantes.

Palabras clave: Fractura de cadera, Osteoporosis, Registros, Anciano

INTRODUCTION

Fragility hip fractures (HF) occur as a consequence of falls from standing height. They are an important health issue, due to their growing frequency in an aging society and the morbimortality and functional dependence they cause[1,2,3,4]. Treating these fractures costs approximately 1,591 million Euros annually, and a total of 7,218 quality-adjusted years of life are lost per year[5,6]. According to a report by the Ministry of Health, the incidence in Spain was 103.76 cases per 100,000 inhabitants / year in 2008, increasing especially above 75 years of age. More recent studies estimate that there are between 40,000 and 45,000 hip fractures in Spain per year, and this number is foreseen to keep increasing, especially among persons older than 80 years old[4,5].

In an effort to minimize the variability in the management of these patients, and to maximize efficiency, several articles and *Clinical Practice Guidelines* (CPGs) have been published, that allow to consensuate and improve the management of hip fractures[7,8,9,10,11,12,13]. Several countries also have national registries of hip fracture patients. The oldest one is the Swedish registry *Rikshöft*, established in 1986, followed by the Scottish registry in 1993. With over 65,000 cases annually, the British registry (initiated in 2007) collects the highest number of cases per year of all the established national registries[14,15]. The information extracted from these registries has allowed for audit of the care process, establishment of quality standards and evaluation of compliance with these standards or deviation from them, introduction of corrective measures and, finally, improvement of the care process and efficiency. Reduction of surgical delay and been demonstrated, with a lower one-year mortality, at least in the British registry[14,16,17].

Spain has ample experience with integrated orthogeriatric care, reflected through numerous publications in the last decades[18], but was lacking a national hip fracture registry. Several regional registries and recent multi-centric studies have been carried out, with different objectives and methodology. Data regarding hip fractures treated during a time period were collected prospectively in Castile-León, as well as in Madrid[19,20]. In Catalonia, a retrospective analysis was performed, crossing data included in several healthcare-related databases[1,21,22], providing information regarding surgical delay, survival and health expenses the year preceding and following hip fractures treated in that region. There are two other important recent multi-centric cohort studies, SPARE-HIP (*SPAnish REgistry of osteoporostic HIP fractures*)[23] and the PROA study (*PRospective Observational study in the burden of hip frActures in Spain*)[24,25].

Including many of the authors of the aforementioned studies[1,18,19,20,21,22,23,24,25], a working group was initiated in 2016 to create a continuous national hip fracture registry in Spain, with interterritorial representation. Its goals were to evaluate the characteristics of the patients treated and the healthcare provided to this process, as well as to provide an instrument that could be used for continuous audit or quality control. In a later stage, national and international comparisons were to be performed, as well as proposals of quality standards and criteria to improve quality of care. From the start, the working group was multidisciplinary, and included professionals who wished to voluntarily participate in the registry, with was called Registro Nacional de Fracturas de Cadera (*Spanish National Hip Fracture Registry, RNFC*). The group currently comprises approximately 190 professionals, mainly geriatricians, internists, orthopedic surgeons, rehabilitation specialists, anesthesiologists and nurses, all of them involved directly in the clinical management of these patients. Its objectives and methodology have been published previously[26,27].

The goal of this study was to present the main results of the first annual report of the RNFC and compare them with those published by other registries and multi-center studies previously performed in Spain.

MATERIAL AND METHODS

Spanish National Hip Fracture Registry (RNFC). The RNFC includes all people aged 75 years or above admitted to the participating hospitals with the diagnosis of a fragility hip fracture.

Data was collected in agreement with the Spanish version of the *Minimum Common Dataset* or FFN-MCD, the minimum common dataset proposed by the Fragility Fracture Network, an international society dedicated to the study and improvement of fragility fracture care[26,28]. The FFN-MCD was agreed upon in 2013 by an international working party comprised fundamentally of representatives of existing national registries. Its goal was to facilitate comparability of established registries and to support the creation of new national registries. This FFN-MCD is concise, covers the key elements of the case-mix, care process and outcome, and is compatible with previously existing databases.

The physician in charge of the patient collected the initial data during acute hospitalization, after provision of informed consent for inclusion in the RNFC. Patients were contacted one month after the fracture telephonically or during a follow-up visit. The project was approved by the local Ethics and Clinical Research Committees (*Comités de Ética e Investigación Clínica* or CEIC) of the participating hospitals. Each participating hospital had a physician of reference locally responsible for the registry.

Data was submitted to the RNFC every three months, in an encrypted manner. A data manager assigned an anonymous identifier to each center, for analysis and later presentation, cleaned the data and performed descriptive analyses and the pertinent associations to periodically elaborate reports. The project was classified by the Spanish Agency for Medications and Sanitary Products (*Agencia Española del Medicamento y Productos Sanitarios*, or AEMPS), as no-EPA (non-postauthorization study), and followed the rules of the 2013 Declaration of Helsinki.

The results presented in this publication are a summary of the data corresponding to the patients included between January and October 2017, comprising the First Annual Report of the RNFC. A descriptive analysis of the information was performed, calculating the means and standard deviations of quantitative variables, and the percentages of the categorical variables.

Comparison with other Spanish multi-centric studies. Comparison with other Spanish registries was performed with the data published by these.

The autonomic registry of Castile-León was a prospective, observational multi-centric study that included patients older than 74 years old admitted for hip fractures in 13 public hospitals of that autonomous community, during November 2014 and November and December of 2015[19].

The autonomic registry of Madrid was a prospective, observational multi-centric study performed between 2015 and 2016, with 8 hospitals from the Community of Madrid that had orthogeriatric hip fracture care participating[20].

The study from Catalonia was a retrospective study that included data of patients 65 years old or older treated for hip fractures between 2009-2011 and between 2012-2016 in Catalonia. Information included in several healthcare-related administrative databases (CMDB, as well as the registries of Primary Care, socio-sanitary

care, mental health and emergencies, insurance registry, pharmaceutical activity and the billing registry of CatSalut) was crossed[1,21,22].

Another two prospective multi-centric and inter-regional cohort studies were analyzed. On the one hand, the SPARE-HIP study (*SPAnish Registry of osteoporotic HIP fracture*) prospectively included 30 consecutive cases from 45 hospitals of several autonomous communities[23]. On the other hand, the PROA study (*PRospective Observational study of the burden of hip frActures in Spain*) prospectively included 487 patients from 6 Spanish autonomous communities, with the goal of evaluating the repercussion of the fractures up to one year after admission, analyzing the patients' quality of life and resource use during follow-up[24,25].

The results of these registries and studies reported in scientific publications were extracted, comparing them with data from the RNFC. The databases of the aforementioned studies were not available for statistical comparison with the RNFC.

RESULTS

The First Annual Report of the RNFC collected data of 7,208 persons aged 75 years and older with fragility hip fractures treated in 54 hospitals in 12 Autonomous Communities. The distribution of patients from each community is presented in table 1.

Profile of the patients with hip fractures included in the RNFC: table 2 summarizes the demographic, clinical and management characteristics of the sample, and their initial evolution. The patients were a mean of 86.7 (SD 5.6) years old (range: 75-108), and 75.1% were women. The percentage of patients

Table 1
Representation of the different Autonomous Communities according to the number of cases and percentage contributed to the National Hip Fracture Registry (RNFC) in 2017.

Autonomous Community	Number of cases	%
Madrid	2,423	33.6
Cataluña	1,308	18.2
Castilla y León	933	12.9
Castilla-La Mancha	919	12.8
Aragón	473	6.6
Galicia	405	5.6
Asturias	388	5.4
Andalucía	102	1.4
Extremadura	79	1.1
C. Valenciana	77	1.1
Islas Canarias	68	0.9
Murcia	33	0.5
Total	7,208	100

with hip fractures that had cognitive decline (defined as 3 or more errors in Pfeiffer's Questionnaire, or SPMSQ) was high (36.4%), as was that of patients with a high surgical risk (67.4%, defined as an ASA III risk or higher according to the American Society of Anesthesiologists score).

Surgical treatment was given to 95.4% of patients, usually with regional anesthesia

Table 2
Patient characteristics and initial evolution of the first 7.208 cases included in the National Hip Fracture Registry (RNFC) (Data in percent, except for age, surgical delay and hospital length of stay).

Characteristics		Result	% lost data
Mean age (years)		86.7 (DE 5.6)	0
Gender (% female)		75.1	0.31
Cognitive decline (patients with SPMSQ>3)		36.4	17.4
High surgical risk (ASA ≥ 3)		67.4	5.6
Type of fracture	Intertrochanteric	51.9	1.1
	Subcapital	39.2	
	Subtrochanteric	7.2	
Patients managed surgically		95.4	2.2
Type of surgery	Cannulated screws	2	2.4
	Sliding screw	1	
	Cephalomedullary nail	56.8	
	Hemiarthroplasty	32.5	
	Total hip arthroplasty	2.9	
Patients operated on with regional anesthesia		88.3	5.2
Patients developing pressure ulcers during hospitalization(*)		6.4	4.4
Patients mobilized on the first postoperative day		55.9	3.1
Collaborating clinician: geriatrics / internal medicine		79.6/13.3	0.9
Surgical delay (hours)		75.7 (DE 63.6)	-
Hospital length of stay (days)		10.9 (DE 6.7)	-
Independent mobility	Pre-fracture	82.7	1.8
	At 30 days	58.9	1.7
Patients readmitted at 30 days(**)		2.4	11
Patients reoperated on at 30 days		2.1	12.3
Mortality at 30 days		7.1	5.8

SPMSQ: Short Portable Mental State Questionnaire de Pfeiffer; ASA: American Society of Anesthesiologists; (*) Grade 2 or above pressure ulcers; (**) Readmissions for surgical reasons; SD: Standard deviation.

(88.3%). The most common surgical techniques performed were fixation with a cephalomedullary nail (56.8%) and replacement with a hemiarthroplasty (32.5%). Surgical delay was high (75.7 hours, SD 63.6), and involved a third of the hospital length of stay, 10.9 days (SD 6.7). Of the surgically treated patients, 55.9% were mobilized out of bed on the first postoperative day. Though 82.7% were able to walk independently (with or without aids) before the fracture, this percentage fell to 58.9% 30 days after the injury.

Table 3 shows the place of residence of the patients included in the RNFC before the fracture, at discharge and at 30-day follow-up. One of every four (23.7%) lived in nursing homes before the fracture. Of the people living at home (75.4%), 37% returned home after discharge, and 39.3% were at home one month later. Upon discharge from acute hospitalization, 23.8% of people registered in the RNFC were sent to geriatric rehabilitation units. One month mortality was 7.1%.

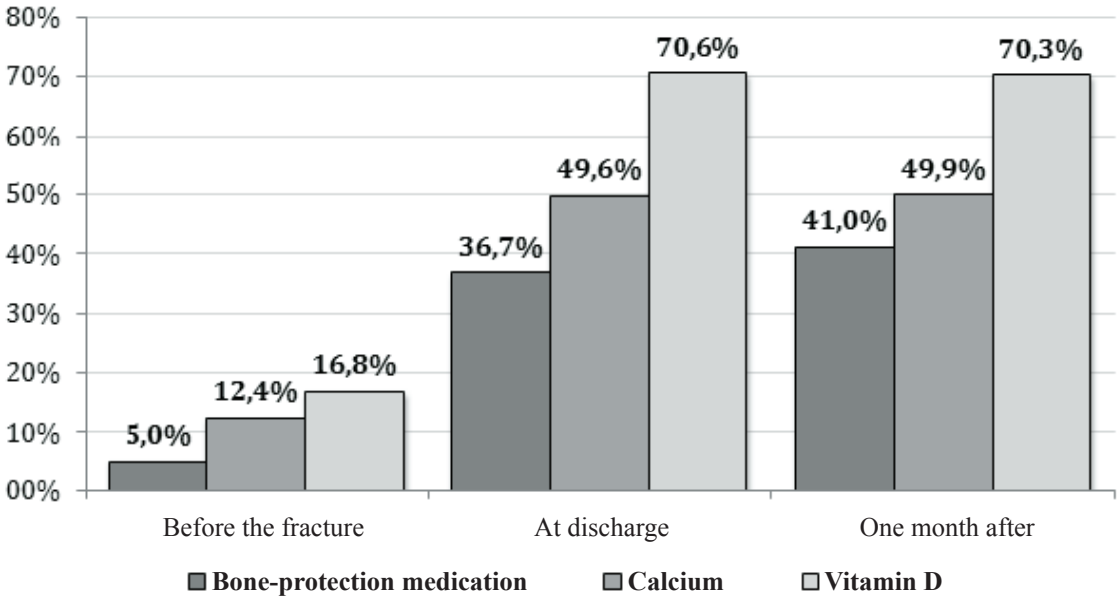
Figure 1 shows the percentage of patients treated with bone-protection medication, calcium and vitamin D before the fracture, at discharge and one month after the fracture. Prescription of bone-protection medication was 5% before the fracture, increased to 36.7% at discharge, and stayed at 41% one month after the fracture.

Comparison with the results of Spanish multicentric studies: table 4 compares the results of the RNFC with other Spanish registries and studies. Some variables allowed for direct comparison, such as age, prior walking ability, the prevalence of cognitive decline, prefracture place

Table 3
Place of residence of the patients included in the National Hip Fracture Registry (RNFC) before the fracture, at discharge and at 30 days (Data as percentage of total).

Place of residence	Pre-fracture	At discharge	At 30 days
Home	75.4	36.9	39.3
Nursing home	23.7	31.9	29.6
Geriatric Rehabilitation Unit	0	23.8	11.9
Acute Hospitalization	0.4	1.0	2.5
Long-term care hospital	0	1.4	0.8
Deceased	0	4.4	7.1
Lost and unknown	0.4	0.5	8.9
Total	100	100	100

Figure 1
Percentage of patients treated with bone-protection medication before the fracture, at discharge and at one month (RNFC 2017).



of residence, the percentage of patients treated surgically and the surgical delay, the type of anesthesia, mean hospital lengths of stay, discharge to nursing homes, prescription of antiosteoporotic treatment and in-hospital mortality.

With 7,208 cases, the RNFC was the Spanish prospective study providing the largest number of cases. It was also the study with the highest mean age of patients. The percentage of patients admitted from nursing homes varied from 11.3% (PROA) to 33.4% (Castile- León), while it ranged from 25.1% (SPARE-HIP) to 63.3% (Castile- León) at discharge. The percentage of patients institutionalized "de novo" varied from 7.7% (SPARE-HIP) to 29.4% (Castile- León).

Surgical delay ranged from 2.5 days to 4 days (SPARE-HIP and Castile-León, respectively), while length of stay did not show any important differences (between 10 days (Castile- León) and 11.8 days (PROA)). One month after the fracture, 4.2% (SPARE-HIP) to 7.7% (Catalonia) of patients had died.

The percentage of patients with antiosteoporotic treatment at discharge oscillated from 14.5% (Castile- León) to 36.7% (RNFC).

DISCUSSION

This paper shows the profile of patients with hip fracture included in the RNFC and compares the registry's results with several Spanish multicentric studies published in the past few years.

Profile of patients with hip fractures included in the RNFC. People with hip fractures

Table 4
Comparison of the results of the first report of the National Hip Fracture Registry (RNFC) with those of other Spanish multi-centric hip fracture studies (Data in percentages except for age, surgical delay and length of stay).

Variables	CATALONIA [1,21,22]	CASTILE-LEÓN[19]	MADRID[20]	SPARE HIP[23]	PROA[24,25]	RNFC
Type of registry	Autonomic retrospective	Autonomic prospective	Autonomic prospective	National prospective	National prospective	National prospective
Inclusion period	2009-2011[1] 2012-2016[21.22]	2014-2015	2015-2016	2014-2016	2011-2012	2017
Number of cases included	38,628	776	3,995	997	487	7,208
Number of participating hospitals	62	13	8	45	28	54
Age of inclusion, years (mean age)	≥65 (84.9)	≥75 (86)	(85.3)	≥50 (83.6)	(83.2)	≥75 (86.7)
Independent walking, pre-fracture / at discharge	-	-	68.7/-	-	77.5/40.4	82.7/58.9
Patients with cognitive decline	21.4	37.8	37	-	19.5	36.4
Pre-fracture place of residence (Home / Nursing care)	83.4/16.6	66.6/33.4	76.2/23.8	82.1/17.4	88.5/11.3	75.4/23.7
Patients treated surgically	94.6(3)	93	96.6	-	95.1	95.4
Mean surgical delay (days)	3	4	3 (median)	2.5	-	3.15
Mean hospital length of stay (days)	11	10	11.2	11.5	11.8	10.9
Operated on with regional anesthesia (%)	-	90.5	95	82.6	-	88.3
Destination at discharge: Home / NC / GRU	55/19/12	36.6/63.3/0	-/-/40.2	49.3/25.1/ 13.9	-	36.9/31.9/ 23.8
New institutionalization	10.5	29.4	9.8	7.7	-	13.6
Prior antiosteoporotic treatment	4.7	-	-	-	15.6	5%
Antiosteoporotic treatment at discharge	-	14.5	-	21.4		36.7
Mortality (in-hospital / at 30 days)	4.5/7.7	4.6	5.3	2.1/4.2	15.8 (year)	4.4/7.1
Collaborating clinician (Geriatrician)	-	100 (100)	100 (100)	61.9 (35.3)	-	92.9 (79.6)

NC: Nursing care; GRU: Geriatric rehabilitation unit.

included in the Spanish RNFC were mainly women of very advanced age, with a high surgical risk and an elevated percentage of previous cognitive decline. These characteristics, that can worsen prognosis, could be more prevalent in this study as it included only patients older than 74 years of age, while other studies included people older than 50 or 65 years of age. A quarter of them lived in nursing homes before the fracture, and among those living at home, less than half of them could return home after discharge from hospital. Almost all patients are treated surgically, and, in spite of a high surgical delay, hospital length of stay is quite constrained. Lack of treatment of osteoporosis before the fracture is the rule, though initiation of treatment at discharge is common. In spite of the efforts of surgical treatment and early mobilization, and of many patients being transferred to geriatric rehabilitation units, a large percentage does not recover the ability to walk independently one month after the fracture.

The simple description of these results exposes some weak points of the hip fracture care process among the participating hospitals, and suggests possible areas of improvement. According to the Organization for Economic Co-operation and Development, Spain is among the countries with the lowest proportion of patients with his fractures operated on in less than 48 hours, standard recommended by several clinical practice guidelines[7,8,9,10,11,12,13]. Increasing the percentage of patients mobilized on the first postoperative day would also be desirable, from the current 58,5% to values around 69-89%, as occurs in other countries[15]. Another goal would be to improve access to functional rehabilitation, to minimize the loss of autonomy observed. In that sense, an analysis of the factors associated with functional decline following a fracture is planned[30,31,32].

Finally, the percentage of patients in whom antiosteoporotic treatment, indicated in several guidelines as secondary prevention following a hip fracture[33,34], is prescribed is lower than recommended. An analysis of the factors influencing the initiation of secondary prevention following fragility hip fractures among the patients included in the RNFC is underway.

Regarding the distribution of the number of patients which each region contributes to the RNFC, we wish to highlight the high participation of the autonomous communities with previous experience in carrying out regional registries, like Madrid, Catalonia and Castile-León[19,20,21,22].

Comparison of the results of the RNFC with Spanish multi-centric studies. The RNFC's results have been compared with those of another five multi-centric studies previously performed in Spain, all of them prospective[19,20,23,24,25], except for the one done in Catalonia[1,21,22], in which information was captured from several existing administrative databases.

Most of the variables related to the patient casemix (age, presence of cognitive decline, pre-fracture place of residence) and many variables describing the care process and outcome (percentage of surgical management and regional anesthesia performed, surgical delay, hospital length of stay, in-hospital mortality) did not differ much between the registries.

Nevertheless, differences can be observed in some aspects. First, the option to transfer patients to geriatric rehabilitation units is practically nonexistent in Castile- León, and this is the reason why perhaps this community showed the highest percentage of new admissions to nursing homes. Second, the percentage of patients living in nursing homes before the fracture was higher in the regional registries

(33% and 23,8% in Castile- León and Madrid, respectively) and in the RNFC (23,7%) than in the multi-centric SPARE-HIP, PROA and Catalan studies (17,4%, 11,3% and 16,6%, respectively). This detail is important, because it is known that institutionalized patients usually have a higher functional and cognitive decline, conditioning their prognosis[35,36]. The RNFC has the vocation of including all of the cases treated in the participating centers in a continuous manner, through which selection bias is expected to be avoided. Finally, the percentage of patients with anti-osteoporotic medication at discharge is much larger in the RNFC than in the other studies. This could be due to greater awareness in light of the results of the previous studies, as well as a participation bias, as participation in the RNFC is voluntary and it could be expected that the participating clinicians are more interested in secondary prevention of fragility fractures.

The RNFC differentiates itself from the other studies by its large number of cases and of centers included, its continuous nature (which includes a follow-up phase), its vocation for clinical audit and improvement of quality of care, and the use of an internationally consensuated database. It is also differs from other systems that classify and capture patient information, such as the Minimum Common Database Set (*Conjunto Mínimo de Bases de Datos*, or CMBD), because these do not include common clinical or functional variables that can condition the patients' prognosis[30], nor do they allow for clinical follow-up, in contrast to the RNFC.

Information from the First Annual Report of the RNFC makes it the registry with the highest number of patients and hospitals of the recent prospective analyses performed in Spain. Furthermore, the number of cases included is growing, as it is a continuous registry, while the other studies were limited in time (between 3-4 months[19,23] and 2 years[20]), or to a small number of cases (30 cases per center[23]). The continuous character of the RNFC makes it an instrument for audit, allowing for evaluation of models of clinical care and outcomes (globally, and for each center individually) over time. It is expected that comparison of results among hospitals, even blinded, would incentivize imitation of best clinical practices, as well as evaluation of the differences existing between autonomous communities.

Another characteristic of the RNFC differentiating it form other studies previously carried out in Spain is the existence of follow-up, absent in the registries of Castile- León and Madrid. Analysis of the situation at one month provides information regarding important outcome measures, such as recovery of the ability to walk, return to home, the readmission and reoperation rates, an one-month mortality.

Use of the FFN-MCD allows for comparison of the results of the Spanish hospitals with those of other countries that follow the recommendations of this network and use their database. The other multi-centric studies do not allow for this possibility, since they use unshared databases, limiting their direct comparability. In this sense, the first comparison of the data collected by the RNFC with that observed with established registries from another 13 countries has been published[15].

An important achievement of the RNFC is having formed a working group of nearly 200 healthcare professionals, originating from most autonomous communities, involved in the clinical management of patients with hip fractures, with the shared goal of improving quality of care. It is also a group of experts who come into contact with each other, share information, organize and/or participate in educational activities and research projects. All this is an innovative project to acquire best clinical practices, culminating in continuous

audit and comparative evaluation, possible thanks to the RNFC. In line with this, a series of indicators and standards to improve quality of care have been proposed[37]. The variability of the processes and outcomes among hospitals and the different autonomous communities is also planned to be analyzed by means of a multilevel analysis.

A weakness of the RNFC is that, in spite of already having a large number of participating hospitals, it is still far from including all of the hospitals in the country. Several new hospitals have started participating throughout 2018, also from autonomous communities previously not represented (Basque Country, Navarre and the Balearic Islands). The 7.208 cases analyzed in this study are an important proportion of the 40.000 to 45.000 cases that occur each year in Spain[5]. Comparisons with the national CMBD are currently underway, to evaluate the representativeness of the sample obtained through the RNFC.

Perhaps the greatest obstacle to the RNFC's survival arises from its source of financing. Though the costs are low, since they are practically limited to hiring a statistician and a technical secretariat, these expenses have been covered until now by donations from the pharmaceutical industry and through research grants. It would be desirable that the public administrations consider the RNFC's interest, and take charge of financing it in the future, as has occurred with the British registry (NHFD)[16,17], ensuring its viability and permanence.

In summary, the data provided by the RNFC allows the characteristics of the included patients to be known in detail, to evaluate differences between participating hospitals, to detect areas in need of improvement and to perform a continuous audit. Comparison with five multi-centric studies on hip fractures previously performed in Spain shows some similarities in the patient characteristics and the care process, but also highlights differences between autonomous communities, such as the likelihood of returning home or receiving secondary prevention of fractures.

The numerous group of participants and researchers of the RNFC are convinced that it is not only possible but necessary to improve the care and the results following a hip fracture and, consequently, the lives of those who suffer one. This group wishes that this publication serve as an invitation to participate in the RNFC, given its vocation to include the largest number of patients with fragility fractures possible throughout the Spanish territory.

REFERENCES

1. Tebé C, Espallargues M, Pons JMV, Cancio JM, Clèries M, Inzitari M et al. La fractura de cuello femoral: evaluación del proceso de atención hospitalario. [Internet]. Barcelona: Ministerio de Sanidad, Servicios Sociales e Igualdad. Agència de Qualitat i Avaluació Sanitàries de Catalunya. Departament de Salut. Generalitat de Catalunya; 2018. (Informes de Evaluación de Tecnologías Sanitarias). Disponible en: http://aquas.gencat.cat/web/.content/minisite/aquas/publicacions/2018/fractura_cuello_femoral_red_aquas2018es.pdf.

2. Herrera A, Martínez AA, Ferrandez L, Gil E, Moreno A. Epidemiology of osteoporotic hip fractures in Spain. Int Orthop. 2006;30(1):11-4.

3. Alvarez-Nebreda ML, Jiménez AB, Rodríguez P, Serra JA. Epidemiology of hip fracture in the elderly in Spain. Bone. 2008;42(2):278-85.

4. Instituto de Información Sanitaria. Estadísticas Comentadas: La Atención a la Fractura de Cadera en los Hospitales del SNS [Internet]. Madrid: Ministerio de Sanidad y Política Social; 2010. Disponible en: http://www.msssi.gob.es/estadEstudios/estadisticas/docs/Estadisticas_comentadas_01.pdf.

5. Azagra R, López-Expósito F, Martin-Sánchez JC, Aguyé A, Moreno N, Cooper C et al. Changing trends in the epidemiology of hip fracture in Spain. Osteoporos Int. 2014;25(4):1267-74.

6. Hernlund E, Svedbom A, Ivergård M, Compston J, Cooper C, Stenmark J et al. Osteoporosis in the European Union: medical management, epidemiology and economic burden. A report prepared in collaboration with the International Osteoporosis Foundation (IOF) and the European Federation of Pharmaceutical Industry Associations (EFPIA). Arch Osteoporos. 2013;8(1-2):136.

7. Bardales Mas Y, González Montalvo JI, Abizanda Soler P, Alarcón Alarcón MT. [Hip fracture guidelines. A comparison of the main recommendations]. Rev Esp Geriatr Gerontol. 2012;47(5):220-7.

8. Pioli G, Barone A, Mussi C, Tafaro L, Bellelli G, Falaschi P et al. The management of hip fracture in the older population. Joint position statement by Gruppo Italiano Ortogeriatria (GIOG). Aging Clin Exp Res. 2014;26(5):547-53.

9. Australian and New Zealand Hip Fracture Registry (ANZHFR). Australian and New Zealand guidelines for hip fracture care: improving outcomes in hip fracture management of adults. Sydney: Australian and New Zealand Hip Fracture Registry Steering Group; 2014. Disponible en: http://www.anzhfr.org/guidelines.

10. Roberts KC, Brox WT. AAOS Clinical Practice Guideline: Management of Hip Fractures in the Elderly. J Am Acad Orthop Surg. 2015;23(2):138-40.

11. National Institute for Health and Care Excellence. Hip fracture. National Institute for Health and Care Excellence. Disponible en: http://www.nice.org.uk/guidance/CG124.

12. British Orthopaedic Association. The Care of Patients with Fragilty Fracture. London: British Orthopaedic Association; 2007. Disponible en: https://www.bgs.org.uk/sites/default/files/content/attachment/2018-05-02/Blue%20Book%20on%20fragility%20fracture%20care.pdf.

13. Sociedad Española de Geriatría y Gerontología, Sociedad Española de Cirugía Ortopédica y Traumatológica. Guía de buena práctica clínica en Geriatría Anciano afecto de fractura de cadera. Barcelona: Elsevier; 2007.

14. Sáez-López P, Brañas F, Sánchez-Hernández N, Alonso-García N, González-Montalvo JI. Hip fracture registries: utility, description, and comparison. Osteoporos Int. 2017;28(4):1157-66.

15. Ojeda-Thies C, Sáez-López P, Currie CT, Tarazona-Santalbina FJ, Alarcón T, Muñoz-Pascual A et al. Spanish National Hip Fracture Registry (RNFC): analysis of its first annual report and international comparison with other established registries. Osteoporos Int. 2019; 30:1243–1254.

16. Johansen A, Golding D, Brent L, Close J, Gjertsen JE, Holt G et al. Using national hip fracture registries and audit databases to develop an international perspective. Injury. 2017;48(10):2174-9.

17. Neuburger J, Currie C, Wakeman R, Tsang C, Plant F, De Stavola B et al. The impact of a national clinician-led audit initiative on care and mortality after hip fracture in England: an external evaluation using time trends in non-audit data. Med Care. 2015;53(8):686-91.

18. González Montalvo JI, Alarcón Alarcón T, Pallardo Rodil B, Gotor Pérez P, Mauleón Álvarez de Linera JL, Gil Garay E. Ortogeriatría en pacientes agudos (I). Aspectos asistenciales. Rev Esp Geriatría Gerontol. 2008;43(4):239-51.

19. Muñoz-Pascual A, Sáez-López P, Jiménez-Mola S, Sánchez-Hernández N, Alonso-García N, Andrés-Sainz AI et al. [Orthogeriatrics: The First multicentre regional register of hip fractures in Castilla y León (Spain)]. Rev Esp Geriatr Gerontol. 2017;52(5):242-8.

20. Molina Hernández MJ, González de Villaumbrosia C, Martín de Francisco de Murga E, Alarcón Alarcón T, Montero-Fernández N, Illán J et al. [Multi-centre register study of hip fractures in Orthogeriatric Units in the Community of Madrid (Spain)]. Rev Esp Geriatr Gerontol. 2019;54(1):5-11.

21. Cancio JM, Vela E, Santaeugenia S, Cleries M, Inzitari M, Ruiz D. Long-term Impact of Hip Fracture on the Use of Healthcare Resources: a Population-Based Study. J Am Med Dir Assoc. 2019, 20(4):456-61.

22. Cancio JM, Vela E, Santaeugenia S, Cleries M, Inzitari M, Ruiz D. Influence of demographic and clinical characteristics of elderly patients with a hip fracture on mortality: A retrospective, total cohort study in North-East Spain. Bone. 2018, 117: 123-9.

23. Prieto-Alhambra D, Reyes C, Sainz MS, González-Macías J, Delgado LG, Bouzón CA et al. In-hospital care, complications, and 4-month mortality following a hip or proximal femur fracture: the Spanish registry of osteoporotic femur fractures prospective cohort study. Arch Osteoporos. 2018;13(1):96.

24. Caeiro JR, Bartra A, Mesa-Ramos M, Etxebarría Í, Montejo J, Carpintero P et al. Burden of First Osteoporotic Hip Fracture in Spain: A Prospective, 12-Month, Observational Study. Calcif Tissue Int. 2017;100(1):29-39.

25. Bartra A, Caeiro J-R, Mesa-Ramos M, Etxebarría-Foronda I, Montejo J, Carpintero P et al. Cost of osteoporotic hip fracture in Spain per Autonomous Region. Rev Esp Cir Ortop Traumatol. 2019;63(1):56-68.

26. Sáez-López P, González-Montalvo JI, Ojeda-Thies C, Mora-Fernández J, Muñoz-Pascual A, Cancio JM et al. Spanish National Hip Fracture Registry (SNHFR): a description of its objectives, methodology and implementation. Rev Esp Geriatr Gerontol. 2018;53(4):188-95.

27. Sáez López P, Ojeda Thies C, González Montalvo JI, Otero Puime Á. Registro Nacional de Fracturas de Cadera por Fragilidad. Informe Anual 2017. 2018. Disponible en: https://www.segg.es/media/descargas/INFORME_RNFC_CON_ISBN.pdf.

28. Fragility Fracture Network. Fragility Fracture Network hip fracture audit database. Minimum common dataset (MCD). Version 1.5. 2014. Disponible en: http://fragilityfracturenetwork.org/.

29. OECD. Health at a Glance 2017: OECD Indicators. Paris: OECD Publishing; 2017.

30. Alarcón Alarcón T, González-Montalvo JI. Fractura osteoporótica de cadera: Factores predictivos de recuperación funcional a corto y largo plazo. An Med Interna. 2004;21:49-58.

31. Handoll HH, Sherrington C, Mak JC. Interventions for improving mobility after hip fracture surgery in adults. Cochrane Database Syst Rev. 2011;(3):CD001704.

32. Bachmann S, Finger C, Huss A, Egger M, Stuck AE, Clough-Gorr KM. Inpatient rehabilitation specifically designed for geriatric patients: systematic review and meta-analysis of randomised controlled trials. BMJ. 2010;340:c1718.

33. Etxebarria-Foronda I, Caeiro-Rey JR, Larrainzar-Garijo R, Vaquero-Cervino E, Roca-Ruiz L, Mesa-Ramos M et al. Guía SECOT-GEIOS en osteoporosis y fractura por fragilidad. Actualización. Rev Esp Cir Ortop Traumatol. 2015;59(6):373-93.

34. González-Macías J, del Pino-Montes J, Olmos JM, Nogués X. Guías de práctica clínica en la osteoporosis posmenopáusica, glucocorticoidea y del varón. Sociedad Española de Investigación Ósea y del Metabolismo Mineral (3.a versión actualizada 2014). Rev Clin Esp. 2015;215(9):515-26.

35. Neuman MD, Silber JH, Magaziner JS, Passarella MA, Mehta S, Werner RM. Survival and functional outcomes after hip fracture among nursing home residents. JAMA Intern Med. 2014;174(8):1273-80.

36. Ríos-Germán PP, Menéndez-Colino R, Ramírez Martin R, Alarcón T, Queipo R, Otero Puime A et al. Baseline and 1-year follow-up differences between hip-fracture patients admitted from nursing homes and the community. A cohort study on 509 consecutive patients (FONDA Cohort). Rev Esp Geriatr Gerontol. 2019 Feb 21. pii: S0211-139X(19)30004-6. doi: 10.1016/j.regg.2018.12.003. [Epub ahead of print].

37. Condorhuamán Alvarado PY, Pareja Sierra T, Muñoz Pascual A, Sáez López P, Ojeda Thies C, Alarcón T et al. Primera propuesta de indicadores y estándares y recomendaciones de mejora de la calidad asistencial en el Registro Nacional de Fractura de Cadera. Rev Esp Geriatr Gerontol. 2019; 54(5): 257-264.