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ORIGINAL ARTICLE

Use of the Barthel Index to measure functional recovery in an elderly population after hip fracture

M. de la Torre-García,* A. Hernández-Santana, N. Moreno-Moreu, R. Luis-Jacinto, J.C. Deive-Maggiolo, J.C. Rodríguez

Servicio de Cirugía Ortopédica y Traumatológica, Unidad de Investigación, Hospital Dr. Negrín, Las Palmas de Gran Canaria, Spain

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KEYWORDS
Hip fracture;
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Abstract
Purpose: To determine how many patients were able to return to their previous independence status after a hip fracture, using the Barthel Index Scale to measure it.
Materials and methods: An observational, prospective longitudinal study of 246 patients over 65 diagnosed with hip fracture. We determined age, sex, type of fracture and treatment, cultural, and economical status, independence level before and after the fracture, and mortality over 12 months.
Results: Of the 246 patients studied, 71.5%were women, and the mean age was 81 years. The Barthel Index Scale before the fracture was 77. Seventy per cent of the patients were capable of walking before the fracture, but only 48%with intracapsular, and 39% with extracapsular hip fracture, reached their previous walking capability. Thirty five patients underwent nonsurgical treatment.
Conclusions: We found that advanced age, dementia, lower education levels, residence-dependent patients, and those who did not have surgical treatment, had lower levels on the Barthel Index Scale at 6 and 12 months. On the other hand, the absence of neurological diseases, attending follow-up clinics, good family care, and high haemoglobin levels prior to the fracture seemed to lead to a better functional recovery.

* Corresponding author.
E-mail: mdelatorre@telefonica.net (M. de la Torre-García).

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PALABRAS CLAVE
Fractura de cadera;
Anciano;
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Índice de Barthel

Recuperación funcional tras fractura de cadera en una población anciana, medida con el índice de Barthel

Resumen
Objetivo: Analizar el grado de recuperación funcional de una serie de pacientes afectados de una fractura de cadera (FC), a los 6 y 12 meses tras la fractura, usando el índice de Barthel (IB) como instrumento de medida.
Material y métodos: Estudio longitudinal prospectivo no intervencionista sobre 246 pacientes mayores de 65 años que acudieron a nuestro centro tras sufrir una FC por un traumatismo de baja energía. Se determinó su edad, sexo, nivel socioeconómico, grado de independencia funcional (IB) tanto previo como a los 6 y 12 meses, y su destino al alta (domicilio, residencia privada o un hospital de crónicos concertado con la consejería) y su mortalidad a los 6 y 12 meses.
Resultados: Las mujeres constituyeron el 71,5% de los casos con una edad media de 81 años. El IB medio previo a la FC fue de 77 puntos. El 70% de los pacientes deambulaban antes de la fractura. De éstos, sólo el 48% que sufrió una FC intracapsular y el 39% de los que sufrieron una FC extracapsular volvieron a caminar a la finalización del estudio (12 meses). En 35 pacientes se desestimó el tratamiento quirúrgico por causas médicas o negativa familiar.
Conclusiones: Los pacientes con edad extrema, demencia, bajos niveles de formación académica, institucionalizados en centros de crónicos y no operados presentaron peor IB a los 6 y 12 meses. El estado neurológico aceptable, acudir a control en la consulta externa, el cuidado familiar y unos niveles altos de hemoglobina preoperatoria se han relacionado con una mejor recuperación funcional en estos pacientes.

Introduction

In our society today, aging is a subject that gets attention from economists, sociologists, politicians, and medical researchers. Hip fracture (HF) in the elderly–the prototypical osteoporotic fracture–has a high morbimortality[1-6] and causes a great number of disabilities, lengthy stays in long-term care facilities, and a marked deterioration in quality of life for these patients.

Evaluation of motor independence is a routine task in medical centres and rehabilitation units. Indices measuring physical disability are being used more and more in research and in clinical practice, especially in the elderly where the incidence of disability is considerably higher than in the general population.[7-9]

With regard to HF, there are few works in the literature that describe functional results vis a vis the type of treatment chosen (surgical or conservative), particularly in terms of the relationship between the patient's socio-cultural level and the extent of his/her functional recovery.[8-12] Completing the questionnaires available for this can be problematic with these patients, for they often have significant cognitive limitations; so there must be a simple, reproducible questionnaire available that does not necessarily require the patient's collaboration.

The Barthel Index (BI)[8] was first used in 1955 in long-term care facilities in Maryland (United States). It was designed to obtain a measure of functional capacity in chronically ill patients, particularly those with neuromuscular and musculo-skeletal disorders, and as a way to periodically evaluate the progress of these patients in rehabilitation programs.

Widely used in geriatrics, the BI is a generic measurement that evaluates the patient's level of independence and self-care in terms of 10 basic activities of daily living, with different scores and weights assigned according to the subject's ability to carry out these activities (table 1). The total score varies from 0 to 100 (90 for patients confined to a wheelchair). It is not a continuous scale: a 5-point change in the high-score range (closer to independence) is not comparable to the same change in the low-score range (closer to dependence).

For a better interpretation, its global results have been grouped into 4 categories of dependence: total, when the result is less than 20; severe, from 20 to 35; moderate, from 40 to 55; and mild, if it is more than 55.

Information is gathered via direct observation and/or questioning of the patient; if the patient's cognitive ability does not permit this, then the patient's caregiver or family members are questioned. Regarding its psychometric merits, it has high concurrent validity with the Katz Index and strong validity in predicting mortality, hospital admission and stay, functional benefit in rehabilitation units, final functional result, capacity to continue living in the community, and capacity to return to work. Its reproducibility is excellent, with weighted kappa coefficients of 0.98 for intra-observer correlation and over 0.88 for inter-observer correlation.[9]

The objective of this study is to describe the parameters that had an effect on functional recovery in a series of hip

Table 1 Barthel Index

Eating	
10	Independent. Able to feed himself/herself. The food may be prepared and served by someone else.
5	Needs help with cutting meat or bread but is able to feed himself/herself
0	Dependent. Must be fed by someone else
Getting dressed	
10	Independent. Able to put on and take off clothing without help
5	Needs help. Completes at least half the tasks by himself/herself within a reasonable time
0	Dependent
Grooming. Personal hygiene	
5	Independent. The items needed may be supplied by someone else
0	Dependent. Needs some help
Bowel control	
10	Continent
5	Occasional accidents. Less than once a week. Needs help with handling catheters or other devices
0	Incontinent
Bladder control	
10	Continent
5	Occasional accidents. Maximum 1 episode of incontinence per 24 hr. Includes needing help with handling catheters or other devices
0	Incontinent
Going to the lavatory	
10	Independent. Enters and leaves by himself/herself. Does not need assistance from someone else
5	Needs help. Able to manage with a little help. Able to wipe himself/herself
0	Dependent. Needs a lot of help
Chair-bed transfer	
15	Independent
10	Minimal assistance. Includes verbal supervision or a little physical assistance
5	A lot of help. Needs the assistance of a strong or trained person
0	Dependent. Needs the lift. Unable to maintain sitting position
Ambulation	
15	Ambulation. Independent. Able to walk 50 metres without assistance. May use instrumental aids (cane, crutches), except for a walker
10	Needs help. Needs supervision or a little physical assistance from someone else. Requires a walker
5	Independent (in wheelchair) at 50 m. Needs no assistance or supervision
0	Dependent
Going up and down stairs	
10	Independent
5	Needs help
0	Dependent

<20: total dependence. 20-40: severe dependence. 40-60: moderate dependence. >60: mild dependence.

fracture patients who were evaluated using the BI at 6 and 12 months after the injury.

Materials and methods

A non-interventional, prospective, longitudinal study of a cohort of patients over 65 years of age who had suffered a HF and were treated at our hospital during a 12-month period (September 2006 to August 2007).

Patients with pathological or high-energy fractures were excluded from this study, as well as those who did not consent to participate. A record card was completed for each patient, with the following information recorded: type of fracture; age and sex; rural or urban origin; whether patient lived alone, with spouse, or with family; whether

Table 2 Distribution of the 2 types of fracture by age, sex, and BI prior to fracture, at 6 months, and at 12 months; mortality at 6 and 12 months

	Age	Sex (F/M)	Barthel index			Mortality	
			Prior	6 m	12 m	6 m	12 m
Extracapsular fractures	82.1	100/34	78.3	51.4	53.3	16.4%	26.1%
Intracapsular fractures	80.9	76/36	76.7	59.6	59.5	18.7%	25%

patient came from home, a private or public residence, or from a Board of Health long-term care facility; and whether patient had a professional caregiver. Information was also collected on the medical conditions most prevalent in this age group (arterial hypertension, diabetes, heart disease, and dementia).

Socio-economic level was determined in terms of the patient's occupation (or, if not available, the head of the family's occupation) and educational level, exactly as proposed by the *Sociedades Españolas de Epidemiología y de Medicina de Familia y Comunitaria* work group.[11] During the admission phase, patients were under the care of the Geriatrics Service at our Centre, and none of them received rehabilitation during this period. Their medical records were reviewed to determine the BI upon admission and at 6 and 12 months after the fracture.

If the patient was unable to return home or to a private residence, he/she was transferred to a Board of Health long-term care facility that had its own rehabilitation service. With the exception of this last group of patients, there was a significant number of patients for whom this therapy was requested or who requested it privately.

Follow-up was conducted exclusively by 1 of the authors (M. de la Torre) and divided almost equally between outpatient clinic visits and telephone interviews, which were necessary because of a 4-month transportation strike coinciding with the study that compromised outpatient follow-up and, on other occasions, because the patient or family member refused to go to the hospital. An attempt was always made to contact the patient and, when his/her cognitive status did not permit this, to contact a person close to the patient (usually an immediate family member) who made a commitment to the follow-up when the informed consent was signed.

$P<.05$ was established as the statistical significance level. The data was analysed using the SPSS statistical package, version 11.5 for Windows.

Results

The number of patients enrolled in the study was 246. Contact with 7 of them was lost during follow-up. There were 134 extracapsular fractures (EF) and 112 intracapsular fractures (IF). The distribution by age and sex, the BI value prior to and at 6 and 12 months after the fracture, and the mortality at 6 and 12 months are shown in table 2, while the patients' occupation and educational level are given in table 3.

Of the patients in this study, 54% belonged to an extensive family milieu, 18% lived with their spouse, and 16% lived alone; 11% were institutionalised in a private or public residence; 63% of patients came from a rural environment and the remaining 37% from an urban environment; and 11% of patients required the services of a caregiver.

Surgical treatment was rejected in 11 EFs and 24 IFs due to medical problems or because the patient or family members refused it.

Table 3 Classification of patients by occupation and education

I. Executives in civil service and companies with 10 or more salaried employees. Professions associated with second and third university cycle degrees [*masters degree or higher*]	7 (3%)
II. Executives in companies with less than 10 salaried employees. Professions associated with a first university cycle degree [*undergraduate*]. Technicians. Artists and Athletes	9 (4%)
III. Administrative-type employees and administrative and financial management support professions. Personal and security services workers. Manual labour supervisors	71 (29%)
IV a. Skilled manual labourers	9 (4%)
IV b. Semi-skilled manual labourers	53 (21%)
V. Unskilled labourers	97 (39%)
I. Uneducated (illiterate + uneducated)	70 (28%)
II. First grade	125 (51%)
III. Second grade, first cycle	23 (9%)
IV. Second grade, second cycle	8 (3%)
V. Third grade	20 (8%)

Table 4 Ability to ambulate and climb stairs and the BI value at different follow-ups for the 2 types of fracture

	Prior to the fracture (n=246)	6 m (n=203)	12 m (n=183)
Moving about			
Independent	172 (70%)	59 (29%)	79 (43%)
Requires assistant	27 (11%)	35 (17%)	16 (9%)
Requires wheelchair	10 (4%)	14 (7%)	13 (7%)
Unable	37 (15%)	95 (47%)	75 (41%)
Climbing stairs			
Independent	98 (41%)	43 (21%)	55 (30%)
Requires assistance	44 (18%)	28 (14%)	20 (11%)
Unable	100 (41%)	132 (65%)	108 (59%)
BI score	77.5	55.5	56.3

The different destinations upon discharge from the hospital were of similar proportions for the 2 types of fracture: 57% returned to their home, 30% to a sponsored Centre, 8% to a private Centre, and 5% died during the admission.

In all cases and for both types of fracture, the starting point, prior to the fracture, was a similar functional situation–mild disability (77±29 points for the IFs and 78±24 for the EFs). At 6 months, a loss of 17 points in the IFs and 28 in the EFs was confirmed, a value that remained invariable until 12 months for both types of fracture. Table 4 shows the progression of the BI and the ability to ambulate and climb stairs independently for the 2 types of fracture.

Advanced age and dementia were associated with a worse previous BI ($P<.001$). Patients who did not undergo surgery were associated with a worse previous BI and higher

Table 5 Correlation between the BI (0 to 100 points) and the variables of being operated or non-operated, dementia, mortality, outpatient clinic attendance, and institutionalisation. Analgesic demand in the operated and non-operated

a. Progression of the BI over time in operated and non-operated patients

	Initial BI	BI at 6 months	BI at 12 months
Total patients	77.5	55.5	56.4
Operated	83.9	58.3	59.4
Non-operated	40.6	22.7	21.6

b. Correlation of dementia with the previous BI and mortality outside the hospital

	BI prior to the fracture	Mortality outside the hospital
Dementia patients	54.3	34%
Non-dementia patients	86.5	15%

c. Correlation of the BI with outpatient clinic attendance

	Discharge (108)	In follow-up (5)	Lost (62)
BI	61.6	69.1	56.3

d. Correlation between the BI and patient institutionalisation (public and private) at 6 and 12 months

	BI at 6 months	BI at 12 months
Home	67	67.4
Institutionalisation	30.8	27.3

e. Progression of analgesic demand in the operated and non-operated with respect to the acute phase

	6 months	12 months
Operated	91.2%better	92%better
Non-operated	100%same	76%same

analgesic demands ($P<.01$). A higher educational level correlated to a higher previous BI ($P=.007$) and final BI ($P=.006$). Patients with a lower educational level were associated with more transfers to a sponsored Centre ($P<.005$). Mean haemoglobin upon admission was 12.2 g/dL and, at discharge, 9.71 g/dL. We found a correlation between high admission haemoglobin levels and a better final BI. The 142 patients who returned to their homes upon discharge from the hospital were associated with a better BI than the 71 who were institutionalised in long-term care facilities ($P<.001$). The 59 patients who stopped coming to the outpatient clinic at some point had a worse final BI than the 118 who were seen in outpatients and discharged ($P=.006$) from there (table 5).

Discussion

The prototypical HF patient in this series was a female, approximately 80 years of age, from a rural area, who had done low-skilled jobs all her working life, had no basic education or very limited education, and belonged to a nuclear family who cared for her.

At 6 months, we ascertained a loss of 17 points in the IFs and 28 points in the EFs. This difference could be explained by the fact that prosthesis is the usual treatment for IFs, which permits almost immediate, unrestricted, weight-bearing ambulation, in contrast to EFs, where osteosynthesis is the routine treatment and, in some cases, weight bearing may not be permitted for up to 6 weeks after surgery.

In this series, we found a significant correlation between high admission haemoglobin levels and a high BI value prior to the fracture. This would be logical from a medical standpoint, but we were not able to confirm it in the literature reviewed.[13,14]

We found no significant difference between the 2 types of fracture in terms of the BI or the mortality at 6 and 12 months.[15-23] Just as in the literature reviewed, we concluded that functional prognosis is independent of the type of fracture.[25-28]

The BI value at 12 months was similar to the previous value (at 6 months), which could be interpreted as functional recovery coming to a standstill. In some of the series reviewed, most of the recovery occurred in the first 6 months, as in this series; in other series, however, a greater recovery was attained in the second 6 months.[25-28]

In recent years on our Service, we have opted not to intervene surgically with bed-ridden and demented patients, with those who have severe associated pathology, and in cases where the patient or family members have expressly refused it; this explains the high percentage of non-operated patients (14%). The BI at 6 and 12 months was better for the operated patients than for the non-operated, who also showed a higher demand for analgesia. This should be taken into consideration when rejecting surgical intervention.

In our series, the portion of elderly patients who were able to ambulate prior to the fracture was high (70%) and comparable for the 2 fracture types. In the case of patients who were not ambulatory at the time of the fracture, the percentage who recovered this ability at 6 and 12 months was 34% and 48%, respectively, for the IFs and 54% and 39%, respectively, for the EFs. These percentages were higher than those obtained by other authors who estimate that only 33% of patients recover the level of independence they had prior to the fracture.[25-28]

In summary, the final objective of surgical intervention–to restore the patient's ability to ambulate independently–was achieved in half of the patients in this series.

The 5% of patients who, prior to the fracture, were institutionalised in different Board of Health Centres became 29% at 6 months and 16% at 12 months. Just as the ability to ambulate independently was diminished, this exemplifies the extent to which their level of recovery is diminished.

At the 1-year follow-up, the 59 patients still living who had stopped coming regularly to the clinic had a worse BI than those who were discharged. The explanation for this could be the erroneous but not uncommon belief among patients and their relatives that going to the clinic is not worth it because it can sometimes be complicated (trips by ambulance, work hours lost, etc.) or because of the perception that the visit will not help to improve the patient. It is also possible, however, that the 118 who did come in and were discharged benefited from the instructions given by the clinic doctor.

During the year following the fracture, the 142 patients who returned to their homes when discharged from the hospital raised their level of independence more than the 71 patients who were transferred to a long-term care facility. Considering that low level of education was the variable most correlated to being transferred to this type of facility, and that higher levels of education were correlated with less disability and more independence at 1 year, it could be said that recovery from HF is more a cultural issue than a medical or financial issue.

Evidence level

Evidence level III.

Protection of human and animal subjects

The authors declare that no experiments were performed on humans or animals for this investigation.

Confidentiality of data

The authors declare that no patient data appears in this article.

Right to privacy and informed consent

The authors must have obtained the informed consent of the patients and / or subjects mentioned in the article. The author for correspondence must be in possession of this document.

Conflict of interest

The authors have no conflict of interest to declare.

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