International Journal of Physical Medicine & Rehabilitation

Thomas, et al., Int J Phys Med Rehabil 2016, 4:3
DOI: 10.4172/2329-9096.1000336

Research Article Open Access

Rehabilitation Care after Hip Fracture in Older Patients with Cognitive Impairment: Systematic Review

Krams Thomas*, Lafont Christine, Voisin Thierry, Castex Annabel, Houles Mathieu and Rolland Yves

Service de rééducation gériatrique, CHU Toulouse, France
***Corresponding author:** Krams Thomas, 170 Avenue de Casselardit, 31 000 Toulouse, France, Tel: 33 5 61 77 66 73; E-mail: krams.t@chu-toulouse.fr

Received date: April 13, 2016; **Accepted date:** May 15, 2016; **Published date:** May 19, 2016

Abstract

Background: Hip fractures (HF) are frequent in older adults. A substantial number of cognitively impaired patients are admitted to rehabilitation units, where they will receive the same care program as non-impaired patients. The aims of this literature review are to describe the results of short, medium and long-term rehabilitation for cognitively impaired patients

Methods: We conducted a systematic review of French and English articles of human studies in MEDLINE via PubMed with the key words “hip fracture“ AND “rehabilitation” AND “dementia." In a second step, the references of selected articles were analyzed and a complementary search on Google Scholar was conduct for an exhaustive literature search. We extracted data on the author name, the journal, year of publication, study design, total number of patients and number of cognitively impaired patients, mean patient age, time and modality of the cognitive assessment, inclusion and exclusion criteria, rehabilitation program, and primary endpoint.

Results: The initial literature search retrieved 147 articles. 16 reports of studies representing 2,255 patients were selected. Our study reveals that multidisciplinary rehabilitation is possible and permits functional gain that persists in the long-term. The intensity of rehabilitation can be as high as for subjects without cognitive impairment. Characteristics of dementia are prognostic factors of rehabilitation (severity of dementia, profile of dementia). Other accessible factors are malnutrition, depression, family.

Conclusion: Concerning patients with cognitive impairment, although our data do not permit establishing recommendations for rehabilitation after HF, some important elements emerged from this review. Additional studies are needed to better define rehabilitation programs adapted to the specificities of the different types of dementia.

Keywords: Dementia; Cognitive impairment; Hip fracture; Rehabilitation

Introduction

Hip fractures (HF) are frequent in older adults. In France, the incidence of hip fracture is estimated at about 50,000 per year, most occurring in patients over 65 years old [1,2]. This incidence is expected to increase in the coming years [3]. With the aging of the population, the combination of cognitive impairment and serious injury with HF is more frequent. A systematic review conducted in 2011 showed that 19.2% of patients hospitalized for HF had a diagnosis of dementia and 41.8% had cognitive impairment [4]. The number of impaired patients hospitalized for HF is expected to increase during the next 20 years [5-7]. HF represents the most frequent pathology in geriatric rehabilitation units and only 33% to 37% of patients return to their previous capabilities after 6 months [8-10].

The aim of rehabilitation is to optimize the potential for recovery. However, cognitive alterations are a limiting factor in rehabilitation because patient with dementia appears to have pejorative outcome after hip fracture [11-13]. A substantial number of cognitively impaired patients are admitted to rehabilitation units, where they will receive the same care program as non-impaired patients. Therefore, understanding rehabilitation for cognitively impaired patients is needed, as are specific rehabilitation programs to optimize functional gain.

The aims of this literature review are to describe the results of rehabilitation at short, medium and long-term after the end of the rehabilitation for cognitively impaired patients concerning functional ability, place of living and duration of hospitalization; describe the most effective rehabilitation program for patients with cognitive impairment; and identify criteria to identify patients with cognitive impairment who are eligible for rehabilitation.

Materials and Methods

Literature search strategy and inclusion and exclusion criteria

We conducted a systematic review of French and English articles of human studies in MEDLINE via PubMED with the key words “hip fracture“ AND “rehabilitation” AND “dementia." Articles published until February 13, 2016 was included.

Inclusion criteria were as follow:

- Prospective cohort studies
- Studies randomized controlled or not

- Studies evaluated the results of a strategy of rehabilitation in patients with HF who were older than 65 years
- Studies including patients with cognitive impairment (received cognitive assessment)
- And studies comparing the results of 2 strategies of rehabilitation in such patients.
- Studies could compare the outcome of cognitively impaired and intact participant or compare outcome of two rehabilitation strategies in cognitively impaired patient.

Exclusion criteria were:

- Case reports
- Studies that not including patient with cognitive impairment.

The Selection process was made by the first author (TK). We first reviewed the titles and abstracts of all retrieved the articles, and then read the full text of potential articles. Selected studies could assess not just patients with cognitive impairment. In a second step, the references of selected articles were analyzed and a complementary search on Google Scholar was conduct for an exhaustive literature search. Finally, we contacted authors of the articles of studies of cognitively impaired patients but without the specific outcomes of interest in their article.

Data extraction

We extracted data on the author name, the journal, year of publication, study design, total number of patients and number of cognitively impaired patients, mean patient age, time and modality of the cognitive assessment, inclusion and exclusion criteria, rehabilitation program, and primary endpoint.

We evaluated the results of the rehabilitation at short, medium and long term after the rehabilitation concerning functional ability, place of living and duration of hospitalization in order describe the most effective rehabilitation program for patients with cognitive impairment; and identify criteria to identify patients with cognitive impairment who are eligible for rehabilitation.

Quality of studies

We evaluated the quality of studies by using a validated scale (Down and Black) [14]. This scale has good reproducibility to assess the quality of randomized and non-randomized studies. It evaluates, on 32 levels, 5 areas (establishment of report, external validity, internal validity, bias, power).

Results

Selection and characteristics of the studies (Figure 1 and Table 1)

The initial literature search retrieved 147 articles (Figure 1). After reading the title and abstract, 124 were eliminated. Among the 23 remaining articles, 6 were included in our review [15-21]; 17 were excluded [9,11,15,21-38]: 7 concerned not demented patients, 5 concerned not rehabilitation, 2 concerned professional surveys, 2 concerned the description of a protocol (no result available), 1 was not accessible. Overall, 9 articles were detected by a search of references or Google Scholar [39-47]. One author provided unpublished data from a study [15]. Finally, 16 reports of studies representing 2,255 patients were selected. Number of patients varies between 11 and 319. Mean age vary between 79 and 84.5.

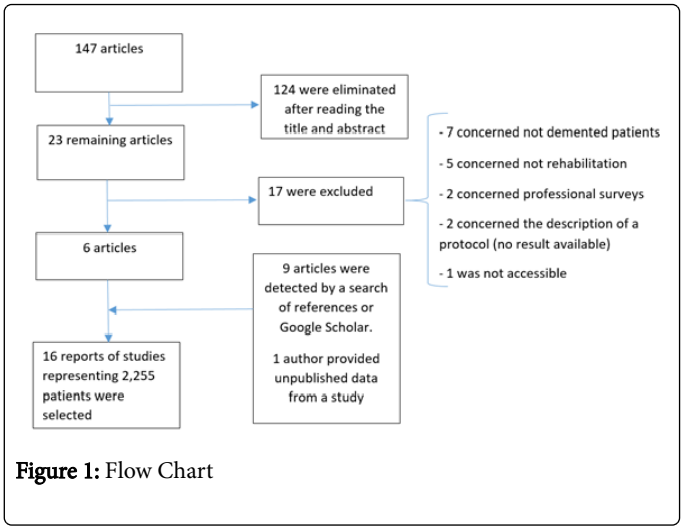

Figure 1: Flow Chart

Among the 16 selected articles, 7 described prospective follow-ups of cohorts [17,18,20,21,41-43] studies, and 9 were of randomized studies comparing 2 strategies of rehabilitation [15,16,19,39,40,44-47]. Among 7 reports of follow-ups of cohorts, 2 [17,18] compared the results of 2 different rehabilitation strategies (home or rehabilitation centre). Other cohort studies followed patients admitted consecutively to one or more rehabilitation services. Outcomes were then compared between patients with and without cognitive impairment.

One study [44] was interrupted prematurely due to modification of the legislation concerning nursing homes in Australia.

The characteristics and quality of all included studies are in Table 1. The studies were generally of average quality, with scores ranging from 13 to 25 out of a possible 32 points.

Study characteristics									
	Reference	**N (cognitive impairment)**	**Type of study**	**Quality score (/32)**	**Length of follow-up (months)**	**Age (median [range])**	**Cognitive assess**	**Time of assessment**	Assessment criteria

						or (mean [SD])	**ment scale**		Residence	Length of hospital stay	Assessment of functional outcome
Cohort studies	Goldstein et al. [21]	58 (35)	Prospective cohort	13	Approximately 1 (output)	84 [71-99]	MDRS	At inclusion (about 14 days)	% at home	-	FIM
	Heruti et al. [20]	204 (54)	Prospective cohort	16	Approximately 1 (output)	80 [65-97]	MMSE, cog FIM	24–48 hr after admission	-	Average length of hospital stay	FIM
	Lenze et al. [41]	97 (38)	Prospective cohort	14	0.5–3	81.7 [8.8]	MMSE	4 days after arrival in rehabilitation	-	-	FIM, MRFS
	Rolland et al. [42]	61 (31)	Prospective cohort	18	Approximately 2 (exit)	84.5 [70-101]	MMSE	3 days after arrival in rehabilitation	-	Average length of hospital stay	FIM, MRFS
	Giusti et al. [18]	96	Comparative prospective cohort	15	3, 6 and 12	I = 84.1 [5.4] C = 84.4 [6.9]	SPMSQ	At admission	-	-	Barthel index
	Lenze et al. [43]	97 (38)	Comparative prospective cohort	14	0.5-4	81.7 [8.8]	MMSE	At the end of the short unit	-	-	FIM
	Al Ani et al. [17]	246 (246)	Prospective cohort	16	4 and 12	85 [68-103]	SPMSQ	MD	-		Capacity to walk ADL
Randomized trials	Kennie et al. [39]	108 (51)	RCT	21	Approximately 1	I=79 [65-94] C=84 [66-94]	SPMSQ	1–7 days after fracture	% at home	Mean length of hospital stay	ADL
	Huusko et al. [19]	243 (14)	RCT	19	3 and 12 after surgery	I=80 [67-92] C=80 [66-97]	MMSE	10 days after surgery	% at home	Mean length of hospital stay	-
	Naglie et al. [40]	279 (74)	RCT	25	3 and 6 after surgery	I=83.8 [6.9] C=84.6 [7.3]	SPMSQ	MD	% at home	-	Capacity to walk
	Vidan et al. [46]	319 (78)	RCT	25	3, 6 and 12	I =81.7 [7,8] C=82.6 [7.4]	MD	MD	-	Average length of hospital stay	ADL
	Uy et al. [44]	11 (11)	RCT	18	1 and 4	I=83 C=80	SPMSQ	At admission	-	-	Barthel index walking speed
	Moseley et al. [45]	160 (54)	RCT	22	1 and 4 after surgery	I=84 [8] C=84 [7]	SPMSQ	MD	-	-	Barthel index Walking speed
	Stenvall et al. [16]	64 (64)	RCT	23	4 and 12 after surgery	I=81 [5.8] C=83.2 [6.4]	MMSE	Pre-existing dementia diagnosis	% at home	-	ADL Ability to walk
	Shyu et al. [47]	160 (51)	RCT	16	1, 3, 6, 12, 18, 24	I=81.3 [6.8]	MMSE	During hospitalization	-	-	ADL Ability to walk

						C=81.7 [7.6]					Recurrence of fall
	McGilton et al. [15]	149 (48)	RCT	24	Until the end of hospitalization	I=82.5 [8.8] C=80.1 [6.7]	MMSE	24 hr after admission	% at home	-	Gain of motor-FIM
RCT: randomized controlled trial, I: intervention group; C: control group; ADL: activities of daily living, FIM: functional independence measure, MRFS: Montebello rehabilitation factor score, MMSE: Mini-Mental Status Evaluation, SPMSQ: short portable mental status questionnaire; MDRS: Mattis Dementia Rating Scale; MD: missing data											

Table 1: Study characteristics

The population characteristics of the studies are in Table 2.

	References	Inclusion criteria
Cohort studies	Goldstein et al. [21]	>65 years old, HF surgery
	Heruti et al. [20]	>65 years old, HF surgery
	Lenze et al. [41]	>60 years old, admitted for rehabilitation after HF, capacity to consent
	Rolland et al. [42]	>70 years old, consecutively admitted for HF rehabilitation in Toulouse
	Giusti et al. [18]	>70 years old, successively admitted to Genoa hospital, underwent surgery, osteoporotic fracture SPMSQ<8
	Lenze et al. [43]	>60 years old, capacity to consent
	Al Ani et al. [17]	>65 years old, dementia, HF, 1 of 4 hospitals University of Stockholm
Randomized trials	Kennie et al. [39]	>65 years old, consultation for HF, female
	Huusko et al. [19]	>65 years old, HF, ability to walk without technical assistance before the fracture
	Naglie et al. [40]	>70 years old, benefited from a surgical support for HF in a Toronto Hospital
	Vidan et al. [46]	>65 years old, hospitalized for HF in a Madrid hospital
	Uy et al. [44]	Women, living in nursing homes, north of Sydney, able to walk before HF
	Moseley et al. [45]	Consecutive admissions in rehabilitation unit after surgery for HF. Possibility to walk 4 steps with assistance. Living in community with the prospect of returning
	Stenvall et al. [16]	>70 years old, consecutive admissions in surgery in Umeå (Sweden) for HF, results only for the subset of patients with dementia
	Shyu et al. [47]	>60 years old, unilateral fracture, arthroplasty or internal fixation, normal range of motion before the fracture, Barthel index >70 before the fracture, northern Taiwan
	McGilton et al. [15]	>65 years old, living at home, transfer to rehabilitation after surgery, with or without cognitive impairment, presence of a caregiver
HF, hip fracture		

Table 2: Characteristic study populations

Assessment of cognitive status

Different scales were used to assess cognitive disorders (Table 1). Mini Mental Status Evaluation (MMSE) was used in 8 studies, Short Portable Mental Status Questionnaire (SPMSQ) in 6 studies the cognitive part of the functional independence measure in 1 study in association with MMSE and Mattis Dementia Rating Scale (MDRS) in one study, and the assessment method was unknown for one study. For 7 studies, cognitive evaluation was conducted in the week following the fracture.

Functional outcomes

The functional ability scales were also extremely heterogeneous (Table 1). Five studies used activities of daily living (ADL) scales [16,17,39,46,47], and 6 used the functional independence measure (FIM) or its motor part [15,20,21,41-43].

Short-term (<3 months): Among the 16 articles, 15 reported on functional outcomes with short-term rehabilitation. A longitudinal cohort study revealed that cognitively impaired patients generally had less functional autonomy at the beginning and end of rehabilitation but comparable gain in absolute function value as non-cognitively impaired subjects [20,21,41,42]. All work comparing 2 strategies of rehabilitation showed that patients with cognitive impairment could have functional gain improved by a specific geriatric care. Moseley et al. [45] highlighted that the median walking speed was greater for cognitively impaired patients in the intervention than control group (+0.2 m/s [range 0.07–0.34], p=0.003) at 4 months.

Medium-term (3–6 months): Six studies comparing 2 rehabilitation strategies gave functional results for the medium term [16,19,40,44,45,47]. All indicated that the benefits of a specialized geriatric care were maintained in the medium term because functional ability was better for cognitively impaired patients than controls. Al-Ani et al. [17] showed that the 2 factors related to functional recovery at 4 months were former ADL (odds ratio [OR]=2.03 [95% CI 1.59–2.58]) and having benefited from rehabilitation (OR=4.24 [1.61–11.17]). Stenvall et al. [16] showed a higher rate of walking ability at 4 months for impaired patients than controls following a specific rehabilitation (21% *vs* 3%, p=0.005). Moseley et al. [45] reported that median 16-week gain in speed was greater in the intervention than control group (+ 0.24 m/sec [range 0.05–0.44], p=0.015).

Long-term (>6 months): Three studies comparing 2 strategies of rehabilitation evaluated the effectiveness of rehabilitation in the long-term (Giusti et al., Al - Ani et al., Stenvall et al.). Positive results in the short- and medium-term seemed to persist in the long-term. In the Al-Ani et al. study [17], the 2 factors associated with functional recovery at 12 months were previous ADL (OR=2.51 [95% CI 1.80-3.50]) and specific rehabilitation care (OR=5.53 [1.44-19.65]). Stenvall et al. [16] revealed that more patients in the rehabilitation than control group regained their previous ability (53% *vs* 21%, p=0.027).

Place of living

Short-term (<3 months): The place of living in the short-term was evaluated in 3 studies: one cohort [21] and 2 randomized studies [26,39]. The cohort study found a non-significant increased risk of institutionalization for cognitively impaired versus non-impaired patients (25% *vs* 54% still living in the community after HF, p=0.141). Two randomized studies revealed that geriatric rehabilitation increased the chances of returning home for cognitively impaired versus non-impaired patients (73% *vs* 54% returning home for the intervention and control groups, respectively, Mcgilton et al. [15]).

Medium-term (3-6 months): Three randomized studies [16,19,40] evaluated the medium-term outcomes. Huusko et al. [19] reported a higher probability of living at home for patients with moderate (Mini-Mental State Examination [MMSE]=12-17) and mild (MMSE=17-23) dementia with than without specific rehabilitation (63% *vs* 17% and 91% *vs* 67% for moderate and mild dementia, respectively). Naglie et al. [40] showed a significant difference concerning the place of living for cognitively impaired patients between the usual-rehabilitation and the intervention group. Stenvall et al. [16] showed no difference in residence between the intervention and control group (80% *vs* 83% of patients with dementia in the geriatric-rehabilitation and usual-rehabilitation group, respectively). In these studies, the information concerning residence before the HF was not indicated.

Long-term (>6 months): Two studies [15,19] assessed place of living at 1 year. For Huusko et al. [19], specific rehabilitation could reduce the rate of institutionalization for patients with moderate dementia (MMSE=12-18) (62% *vs* 33% of patients living at home in the classic-rehabilitation and intervention group, respectively). This was not the finding for the mildly or severely impaired patients. Stenvall et al. [16] found no difference in residence for cognitively impaired patients with a program.

Length of stay in rehabilitation care

Duration of hospitalization was evaluated in 2 cohort studies and 3 randomized studies. In the cohort studies, length of stay was longer for cognitively impaired than non-impaired patients: +2 days on average in the Goldstein et al. study [21] and 28.2 ± 13 versus 21.2 ± 9.2 days for impaired versus non-impaired patients (p<0.001) in the Heruti et al. study [20].

Three randomized studies showed that duration of hospitalization was shorter in the intervention than control group. In the Kennie et al. study [39], length of stay was shortened by geriatric support for patients with mild, moderate, and severe dementia (25 *vs* 31 days, 21 *vs* 61 days and 53 *vs* 66 days, respectively). In the Huusko et al. study [19], the length of stay was decreased with geriatric rehabilitation only for patients with MMSE 12 to 17 and 18 to 23 (47 *vs* 147 days, p=0.042, and 29 *vs* 46 days, p=0.002, respectively). In the Stenvall et al. study [16], although not significant, a specific geriatric rehabilitation decreased the duration of hospitalization (20 ± 12 days *vs* 32.1 ± 35.5 days, p=0.059).

Description of interventions

Interventions are described in Table 3. The main information provided was location, stakeholders, and intensity. No article accurately described the rehabilitation techniques used. Length of intervention is described only in two articles [19,45].

Intervention			
	References	**Intervention**	**Control**
Cohort studies	Goldstein et al. [21]	-Geriatric hospital -18-bed in a rehabilitation unit -multidisciplinary (physiotherapist, occupational therapist, psychologist, dietician, occupational therapist) -Intensity: 3 hr/day -Interviews of family	

	Heruti et al. [20]	- 30-bed in geriatric center -multidisciplinary (physiotherapist, occupational therapist, psychologist, social worker, geriatrician) -weekly multi-disciplinary meeting -rehabilitation 6 hr/week, 6/7 days	
	Lenze et al. [41]	MD	
	Rolland et al. [42]	-Geriatric rehabilitation centre - multidisciplinary (physiotherapy, occupational therapy, dietician, geriatrician) -weekly multi-disciplinary meeting -2 daily sessions of rehabilitation of 1 hr -5 days/week	
	Giusti et al. [18]	- Home -Programs determined by the physiotherapist	-Rehabilitation centre
	Lenze et al. [43]	-Rehabilitation centre -3 hr/day - multi-disciplinary rehabilitation (physiotherapy or occupational therapy)	-Nursing care center -up to 2 daily sessions -less contact with physicians
	Al Ani et al. [17]	-Rehabilitation centre -Physiotherapy and occupational therapy daily	-residence -Physical therapy several times a week
Randomized trials	Kennie et al. [39]	-Peripheral hospital -multidisciplinary (physiotherapy, occupational therapy, speech-language pathologist, dietician) -visit a geriatrician 3 times/week -multidisciplinary meeting once per week -easy access to orthopedic opinion	-Department of orthopedics -access to physical therapy and occupational therapy
	Huusko et al. [19]	-Central hospital -geriatric rehabilitation centre -3 weeks -2 sessions/day -Motivation meeting, activities by nurse outside the rehabilitation sessions -multidisciplinary (occupational therapist, physiotherapist, psychologist, social worker, geriatrician, general practitioner, neurologist) -weekly meeting -visits home before and after the release -family interview	-local hospital
	Naglie et al. [40]	-Specific hospital service - multidisciplinary (physiotherapist, occupational therapist, social worker) -post-operative early -research and prevention of geriatric complications -early mobilization -stimulation for activities of daily living -training of personnel for elderly care -supervision by a geriatrician -weekly meeting -rehabilitation twice/day, 5/7 days	-Specific hospital service -More limited access to physical therapist and occupational therapist -No staff trained -Possibility of geriatric consultation only on request of the orthopedics team

	Vidan et al. [46]	-Orthopedics units -Daily evaluation by a geriatrician, -multidisciplinary (social worker, psychologist, geriatrician, orthopedic) -Evaluation 72 hr after the operation to set the rehabilitation program -weekly multi-disciplinary meeting.	-Orthopedics units -Evaluation by nurse and surgeon -Specialized geriatric opinion only at the request of the orthopaedic team
	Uy et al. [44]	-Rehabilitation unit - Multidisciplinary rehabilitation program using the principle of accelerated rehabilitation (undescribed)	- Nursing home
	Moseley et al. [45]	-Rehabilitation unit -16 weeks -2 daily sessions -1 hr/day -Exercises in charge, relieved support exercises, walking exercises, rang of motion and force exercise -Gradual increase of the intensity and the number of repetitions -gradual reduction of the relief of the body weight -Training of different types of walking. Training of chair lift -continuing rehabilitation at home -Visits at home after hospitalization.	-Rehabilitation unit -4 weeks. 30 min/day -discharge exercise (bed or standing) -walk between parallel lines -Gradual increase in number of repetitions -No home visits after hospitalization
	Stenvall et al. [16]	- Geriatric unit -Detection and early treatment of complications (standardized geriatric assessment) -early mobilization -multidisciplinary (physiotherapist, occupational therapist, dietician, geriatrist) -12 patients for one physiotherapist and occupational therapist -education of nurse -1.07 nurse/patient -Evaluation 4 months after hospitalization.	-Orthopedics unit -nurse 1.01/patient -No education of nurse -14 patients for one physiotherapist -54 patients for one occupational therapist
	Shyu et al. [47]	-Orthopedic unit and living place -Geriatric assessment -Development of a rehabilitation program -rehabilitation program at home -begin 1 day after surgery and until 3 months after the hospitalization -During hospitalization: 4 visits to geriatric nurse, 2 visits to a physical therapist and a physical medical visit -After the hospitalization: 8 visits of a nurse and 3 visits of physiotherapist during the first 3 months -adaptation of the living place	-Orthopedic unit and residence -During hospitalization: 3 visits of physiotherapist -after hospitalization: no visit
	McGilton et al. [15]	-Rehabilitation unit -Rehabilitation care -delirium prevention program -Education of health professionals -Education of family caregivers -Use of REAP model (Relate well, modification of the Environment, emphasis on Abilities-focused care, concept of Personhood)	-Rehabilitation unit -Initial assessment -Physiotherapy or occupational therapy 1 hr/day -Improvement of range of motion and force -No cognitive evaluation

Table 3: Intervention

Factors of the rehabilitation in prognosis

We found several criteria that could influence the results of the rehabilitation after HF in cognitively impaired patients.

Severity of dementia: Rolland et al. [23] showed that patients with low FIM at the end of the rehabilitation had the most severe dementia. However, Huusko et al. [17] found that geriatric care was beneficial for patients with moderate dementia (MMSE=12-18) but not severe dementia (MMSE<11). In Naglie et al. [21], rehabilitation was more beneficial for patients with mild to moderate than severe dementia. In the Kennie et al. study [20], geriatric care benefitted patients with moderate or severe dementia than beginning dementia.

Cognitive profile: Goldstein et al. [19] evaluated the association between the success of rehabilitation and the cognitive altered domain. The preservation of memory (p=0.026), conceptualization (p=0.003) and initiation/perseverence (p=0.003) on the Mattis Dementia Rating Scale was associated with improved FIM score at the end of rehabilitation. The preservation of initiation/perseverence and conceptualization was associated with improved FIM during rehabilitation (p=0.047 and p=0.031, respectively).

Previous autonomy: Autonomy before the HF is an important prognostic factor of functional outcome [11,15,19,23]. For example, for Al-Ani et al. [15], the preservation of ADL after rehabilitation in cognitively impaired patients was associated with ADL before the HF (OR=2.03 [95% CI 1.59-2.58], p<0.001, at 4 months and 2.51 [1.80-3.50], p<0.001 at 12 months).

Other prognostic factors: Previous functional ability [15,23], nutritional status, and the presence of a family [11] and depression [23].

Discussion

Few data exist on rehabilitation after HF [48-50]. Although HF is frequent among older patients with cognitive impairment, we have few data to optimize the rehabilitation of these patients. Our systematic review included 16 studies of variable quality on this topic. Therefore, the level of evidence presented is limited and conclusions must be formulated carefully.

We found substantial heterogeneity concerning rehabilitation programs investigated as well as the assessment of cognitive impairment, functional ability, the time of the evaluation or the study design, so interpretation of results is complicated. The development of recommendations for the rehabilitation of cognitively impaired patients based on only these data seems impossible.

Concerning the rehabilitation strategy, this review does not allow for defining recommendations. Nevertheless, the following items resulted in positive outcomes in the studies examined:

Location of program

A geriatric rehabilitation service. Only one study (Giusti) evaluated the effectiveness of the rehabilitation in the patient's place of living and found positive results.

Participants

Multidisciplinary team of physician geriatrician and therapist, physical therapist, occupational therapist, dietician, neuropsychologist, nurse. Several studies [15,16,40] proposed specific training of the medical team in support of older patients. A weekly meeting was proposed in all studies.

Intensity

Different programs were offered with different levels of intensity, which is broadly comparable to what is generally offered to older patients without cognitive impairment. The intensity is from 2 to 3 hr/day divided into 2 sessions, 5 to 6 days/week.

Duration

The duration of the rehabilitation is poorly described and actually depends on each situation.

Some factors appear to be able to be associated with the results of the rehabilitation in patients: the severity of dementia [19,39,40,42], type of deficit [21], previous autonomy [17,21,31,42], existence of a depressive syndrome [43], nutritional status and presence of family members [15].

The most appropriate tool for evaluating the results of rehabilitation cannot be determined. The 2 most commonly used scales are the ADL and the FIM. Evaluating effectiveness of rehabilitation of patients with cognitive impairment seems more logical with functional than analytical scales such as range of motion or muscle strength.

The originality of this review is the evaluation of predictive factors of success or failure of rehabilitation. We highlight some factors of success of the rehabilitation after HF.

This study also has limitations. First, given the heterogeneity of the data, very disparate results were found with 9 randomized studies and 7 cohort studies. In addition, data concerning cognitively impaired patients were generally post-hoc analyses of randomized trials. Second, the search and selection of articles involved only one database (MEDLINE), so certain articles may have been missed. Finally, the generalization of the results requires that studies include patient's representative of the target population, and the low rate of recruitment of our studies (Table 2) complicated the generalization of the results.

Conclusions

Concerning patients with cognitive impairment, although our data do not permit establishing recommendations for rehabilitation after HF, some important elements emerged from this review. Multidisciplinary rehabilitation is possible and permits functional gain that persists in the long-term. Rehabilitation in a non-geriatric unit produces worse outcomes than that in a geriatric rehabilitation unit. The intensity of rehabilitation can be as high as for subjects without cognitive impairment. Characteristics of dementia are prognostic factors of rehabilitation (severity of dementia, profile of dementia). Other accessible factors (malnutrition, depression, family) should be considered to evaluate the prognosis of rehabilitation. Most studies are secondary analysis and concern heterogeneous population which complicated the generalization of the results. Additional studies are needed to better described (type and intensity of exercise, location, category and number of participant, length, objective) rehabilitation programs adapted to the specificities of the different types of dementia.

References

1. Briot K, Maravic M, Roux C (2015) Changes in number and incidence of hip fractures over 12 years in France. Bone 81: 131-137.

2. Haute autorité de santé (2007) Evaluation des protheses de hanche.
3. Johnell O, Kanis JA (2004) An estimate of the worldwide prevalence, mortality and disability associated with hip fracture. Osteoporos Int 15: 897-902.
4. Seitz DP, Adunuri N, Gill SS, Rochon PA (2011) Prevalence of dementia and cognitive impairment among older adults with hip fractures. J Am Med Dir Assoc 12: 556-564.
5. Adunsky A, Lusky A, Arad M, Heruti RJ (2003) A comparative study of rehabilitation outcomes of elderly hip fracture patients: the advantage of a comprehensive orthogeriatric approach. J Gerontol A Biol Sci Med Sci 58: 542-547.
6. Gruber-Baldini AL, Zimmerman S, Morrison RS, Grattan LM, Hebel JR, et al. (2003) Cognitive impairment in hip fracture patients: timing of detection and longitudinal follow-up. J Am Geriatr Soc 51: 1227-1236.
7. Maravic M (2013) Epidrmiologie des fractures de hanches. Realites en rhumatologie.
8. Magaziner J, Hawkes W, Hebel JR, Zimmerman SI, Fox KM, et al. (2000) Recovery from hip fracture in eight areas of function. J Gerontol A Biol Sci Med Sci 55: M498-507.
9. Seitz DP, Gill SS, Gruneir A, Austin PC, Anderson GM, et al. (2014) Effects of dementia on postoperative outcomes of older adults with hip fractures: a population-based study. J Am Med Dir Assoc 15: 334-341.
10. Morrison RS, Siu AL (2000) A comparison of pain and its treatment in advanced dementia and cognitively intact patients with hip fracture. J Pain Symptom Manage 19: 240-248.
11. Hedman AM, Grafström M (2001) Conditions for rehabilitation of older patients with dementia and hip fracture--the perspective of their next of kin. Scand J Caring Sci 15: 151-158.
12. Chaplin Vk, Matharu GS, Knebel RWC (2013) Complications following hemiarthroplasty for displaced intracapsular femoral neck fractures in the absence of routine follow-up. Ann R Coll Surg Engl 95: 271-274.
13. Bentler SE, Liu L, Obrizan M, Cook EA, Wright KB, et al. (2009) The aftermath of hip fracture: discharge placement, functional status change, and mortality. Am J Epidemiol 170: 1290-1299.
14. Downs SH, Black N (1998) The feasibility of creating a checklist for the assessment of the methodological quality both of randomised and non-randomised studies of health care interventions. J Epidemiol Community Health 52: 377-384.
15. McGilton KS, Davis AM, Naglie G, Mahomed N, Flannery J, et al. (2013) Evaluation of patient-centered rehabilitation model targeting older persons with a hip fracture, including those with cognitive impairment. BMC Geriatr 13: 136.
16. Stenvall M, Berggren M, Lundström M, Gustafson Y, Olofsson B (2012) A multidisciplinary intervention program improved the outcome after hip fracture for people with dementia--subgroup analyses of a randomized controlled trial. Arch Gerontol Geriatr 54: e284-289.
17. Al-Ani AN, Flodin L, Söderqvist A, Ackermann P, Samnegård E, et al. (2010) Does rehabilitation matter in patients with femoral neck fracture and cognitive impairment? A prospective study of 246 patients. Arch Phys Med Rehabil 91: 51-57.
18. Giusti A, Barone A, Pioli G (2007) Rehabilitation after hip fracture in patients with dementia. J Am Geriatr Soc 55: 1309-1310.
19. Huusko TM, Karppi P, Avikainen V, Kautiainen H, Sulkava R (2000) Randomised, clinically controlled trial of intensive geriatric rehabilitation in patients with hip fracture: subgroup analysis of patients with dementia. BMJ 321: 1107-1111.
20. Heruti RJ, Lusky A, Barell V, Ohry A, Adunsky A (1999) Cognitive status at admission: does it affect the rehabilitation outcome of elderly patients with hip fracture? Arch Phys Med Rehabil 80: 432-436.
21. Goldstein FC, Strasser DC, Woodard JL, Roberts VJ (1997) Functional outcome of cognitively impaired hip fracture patients on a geriatric rehabilitation unit. J Am Geriatr Soc 45: 35-42.
22. Horikawa A, Miyakoshi N, Shimada Y, Kodama H (2014) Comparison of activities of daily living after osteoporotic hip fracture surgery in patients admitted from home and from geriatric health service facilities. Clin Interv Aging 9: 1847-1851.
23. Tan AK, Taiju R, Menon EB, Koh GC (2014) Postoperated hip fracture rehabilitation effectiveness and efficiency in a community hospital. Ann Acad Med Singap 43: 209-215.
24. Allen J, Koziak A, Buddingh S, Liang J, Buckingham J, et al. (2012) Rehabilitation in patients with dementia following hip fracture: a systematic review. Physiother Can Physiothérapie Can 64: 190-201.
25. Vochteloo AJH, van Vliet-Koppert ST, Maier AB, Tuinebreijer WE, Röling ML, et al. (2012) Risk factors for failure to return to the pre-fracture place of residence after hip fracture: a prospective longitudinal study of 444 patients. Arch Orthop Trauma Surg 132: 823-830.
26. McGilton KS, Davis A, Mahomed N, Flannery J, Jaglal S, et al. (2012) An inpatient rehabilitation model of care targeting patients with cognitive impairment. BMC Geriatr 12: 21.
27. Buddingh S, Liang J, Allen J, Koziak A, Buckingham J, et al. (2001) Rehabilitation for long-term care residents following hip fracture: a survey of reported rehabilitation practices and perceived barriers to delivery of care. J Geriatr Phys Ther 36: 39-46.
28. Cook WL, Khan KM, Bech MH, Brasher PM, Brown RA, et al. (2011) Post-discharge management following hip fracture--get you back to B4: a parallel group, randomized controlled trial study protocol. BMC Geriatr 11:30.
29. Pretto M, Spirig R, Kaelin R, Muri-John V, Kressig RW, et al. (2010) Outcomes of elderly hip fracture patients in the Swiss healthcare system: A survey prior to the implementation of DRGs and prior to the implementation ofa Geriatric Fracture Centre. Swiss Med Wkly 140: w13086.
30. Muir SW, Yohannes AM (2009) The impact of cognitive impairment on rehabilitation outcomes in elderly patients admitted with a femoral neck fracture: a systematic review. J Geriatr Phys Ther 32: 24-32.
31. McGilton KS, Mahomed N, Davis AM, Flannery J, Calabrese S (2009) Outcomes for older adults in an inpatient rehabilitation facility following hip fracture (HF) surgery. Arch Gerontol Geriatr 49: e23-31.
32. Bellelli G, Frisoni GB, Pagani M, Magnifico F, Trabucchi M (2007) Does cognitive performance affect physical therapy regimen after hip fracture surgery? Aging Clin Exp Res 19: 119-124.
33. Stenvall M, Olofsson B, Nyberg L, Lundström M, Gustafson Y (2007) Improved performance in activities of daily living and mobility after a multidisciplinary postoperative rehabilitation in older people with femoral neck fracture: a randomized controlled trial with 1-year follow-up. J Rehabil Med 39: 232-238.
34. Penrod JD, Boockvar KS, Litke A, Magaziner J, Hannan EL, et al. (2004) Physical therapy and mobility 2 and 6 months after hip fracture. J Am Geriatr Soc 52: 1114-1120.
35. Beloosesky Y, Grinblat J, Epelboym B, Hendel D (2001) Dementia does not significantly affect complications and functional gain in elderly patients operated on for intracapsular hip fracture. Arch Orthop Trauma Surg 121: 257-260.
36. Marcantonio ER, Flacker JM, Wright RJ, Resnick NM (2001) Reducing delirium after hip fracture: a randomized trial. J Am Geriatr Soc 49: 516-522.
37. van Dortmont LM, Douw CM, van Breukelen AM, Laurens DR, Mulder PG, et al. (2000) Outcome after hemi-arthroplasty for displaced intracapsular femoral neck fracture related to mental state. Injury 31: 327-331.
38. Rozzini R, Frisoni GB, Barbisoni P, Trabucchi M (1997) Dementia does not prevent the restoration of safe gait after hip fracture. J Am Geriatr Soc 45: 1406-1407.
39. Kennie DC, Reid J, Richardson IR, Kiamari AA, Kelt C (1988) Effectiveness of geriatric rehabilitative care after fractures of the proximal femur in elderly women: a randomised clinical trial. BMJ 297: 1083-1086.
40. Naglie G, Tansey C, Kirkland JL, Ogilvie-Harris DJ, Detsky AS, et al. (2002) Interdisciplinary inpatient care for elderly people with hip fracture: a randomized controlled trial. CMAJ Can Med Assoc J J Assoc Medicale Can 167: 25-32.

41. Lenze EJ, Munin MC, Dew MA, Rogers JC, Seligman K, et al. (2004) Adverse effects of depression and cognitive impairment on rehabilitation participation and recovery from hip fracture. Int J Geriatr Psychiatry. 19: 472-478.
42. Rolland Y, Pillard F, Lauwers-Cances V, Busquère F, Vellas B, et al. (2004) Rehabilitation outcome of elderly patients with hip fracture and cognitive impairment. Disabil Rehabil 26: 425-431.
43. Lenze EJ, Skidmore ER, Dew MA, Butters MA, Rogers JC, et al. (2007) Does depression, apathy or cognitive impairment reduce the benefit of inpatient rehabilitation facilities for elderly hip fracture patients? Gen Hosp Psychiatry 29: 141-146.
44. Uy C, Kurrle SE, Cameron ID (2008) Inpatient multidisciplinary rehabilitation after hip fracture for residents of nursing homes: a randomised trial. Australas J Ageing 2: 43-44.
45. Moseley AM, Sherrington C, Lord SR, Barraclough E, St George RJ, et al. (2009) Mobility training after hip fracture: a randomised controlled trial. Age Ageing. 38: 74-80.
46. Vidán M, Serra JA, Moreno C, Riquelme G, Ortiz J (2005) Efficacy of a Comprehensive Geriatric Intervention in Older Patients Hospitalized for Hip Fracture: A Randomized, Controlled Trial. J Am Geriatr Soc 53: 1476-1482.
47. Shyu YL, Tsai WC, Chen MC, Liang J, Cheng HS, et al. (2012) Two-year effects of an interdisciplinary intervention on recovery following hip fracture in older Taiwanese with cognitive impairment. Int J Geriatr Psychiatry 27: 529-538.
48. Toussant EM, Kohia M (2005) A critical review of literature regarding the effectiveness of physical therapy management of hip fracture in elderly persons. J Gerontol A Biol Sci Med Sci 60: 1285-1291.
49. Cameron ID, Handoll HH, Finnegan TP, Madhok R, Langhorne P (2009) WITHDRAWN: Co-ordinated multidisciplinary approaches for inpatient rehabilitation of older patients with proximal femoral fractures. Cochrane Database Syst Rev 4: CD000106.
50. Prestmo A, Hagen G, Sletvold O, Helbostad JL, Thingstad P, et al. (2015) Comprehensive geriatric care for patients with hip fractures: a prospective, randomised, controlled trial. Lancet 385: 1623-1633.