

The Impact of Cognitive Impairment on Rehabilitation Outcomes in Elderly Patients Admitted with a Femoral Neck Fracture: A Systematic Review

Susan W. Muir BScPT,¹ Abebaw M. Yohannes, PhD, MSc, MCSP, SRP²

¹ PhD candidate, Department of Epidemiology and Biostatistics, Schulich School of Medicine and Dentistry, University of Western Ontario, London, Ontario, Canada

² Faculty of Health, Social Care & Education; School of Health, Psychology & Social Care; Professional Registration Division, Manchester Metropolitan University, Manchester, UK

ABSTRACT

Objective: To evaluate the evidence of rehabilitation outcomes after the surgical repair of a hip fracture in older people with cognitive impairment.

Design: Systematic review.

Methods: Searches were conducted in MEDLINE, EMBASE, CINAHL, PsycINFO, Cochrane Library (Cochrane Database of Systematic Reviews, Database of Abstracts of Reviews of Effectiveness, and Cochrane Controlled Trials Register), ProQuest Dissertations, and Theses Database and bibliographies of extracted publications in the English language between 1990 and June 2007. Search terms included: dementia/Alzheimer disease/cognitive impairment, hip fracture, rehabilitation, outcome assessment/treatment outcome. Two independent reviewers undertook screening and methodological quality assessment, using the Downs and Black rating scale, of the extracted articles. Only studies evaluating rehabilitation outcomes with data analysis specific for cognitive status were evaluated. Sackett's levels of evidence were used to summarize the main findings.

Findings: Eleven studies met the inclusion criteria. Methodological quality of the studies ranged from fair to poor. The generalizability of study findings was limited by multiple rehabilitation settings in the acute and subacute phase postsurgery, multiple methods with varying thresholds for determining cognitive impairment and multiple functional outcome scales.

Conclusion: There is some evidence that older adults with cognitive impairment who receive intensive inpatient rehabilitation after surgical repair of a hip fracture may be able to gain

comparable benefit in physical function as cognitively intact patients. There is not enough information to guide recommendations of specific physical therapy interventions to optimize outcomes in this patient population. Further work is needed.

Key Words: systematic review, rehabilitation, hip fracture, older adults, dementia/cognitive impairment

INTRODUCTION

Hip fractures are the second leading cause of hospitalization in people 65 years and older, and over 90% of hip fractures are due to falls.¹⁻³ The incidence of hip fractures varies with age and gender ranging from 22.5 per 100,000 at age 50 for men to 1289.3 per 100,000 by age 80 for women.⁴⁻⁶ Several studies have reported increased health care costs in the first year after a hip fracture due to hospitalization, attending rehabilitation services, and admissions to long-term care.⁷⁻⁹ Permanent placement in long-term residential care after hip fracture for older adults ranges from 27% to 59.4% in the first year.^{10,11} The annual economic cost of hip fracture care was \$650 million (Canadian) in 1995, and has been projected to increase to \$2.4 billion by 2041.¹²

Cognitive impairment increases fall risk 5-fold and carries a 2.2 increased risk for an injurious fall among community-dwelling older adults.^{3,13} The prevalence of dementia also varies with increasing age with estimates range from 2.4% for age 65 to 34.5% for people over the age of 85 years.^{12,14} Among community-dwelling older adults who sustain a hip fracture, the prevalence of dementia is estimated at 50%, of whom only 28% had the diagnosis of dementia pre-fracture.¹⁵ The new onset of cognitive impairment after hip fracture is believed to be as the result of hospitalization exacerbating or exposing symptoms of preclinical dementia, physiological changes due to stress of the injury, and side effects of medical care, in particular the use of analgesics and anaesthesia.^{15,16}

The goal of rehabilitation is to maximize function to the pre-fracture level, though up to 74% of individuals may not recover to full pre-fracture function.¹⁷ Additionally, chronic and acute cognitive impairment are independent risk factors for a poorer outcome after hip fracture.¹⁷⁻²¹ The behavioural and cognitive impairment can affect an individual's ability to participate effectively in rehabilitation thereby impacting on the delivery of care.²²⁻²⁷ Studies have demonstrated that older people with mild to moderate cognitive impairment are capable of gaining functional improvement from inpatient rehabilitation and able to maintain the functional gains up to 12 months.²⁸⁻³³ The generalizability of these results is limited due to the heterogeneity of the sample and often the studies include patients with stroke, elective orthopaedic surgery, and traumatic hip fracture.²⁸⁻³³

Address all correspondence to:

Ms. Susan W. Muir, Graduate Student,
Department of Epidemiology and Biostatistics,
Schulich School of Medicine and Dentistry,
The University of Western Ontario, Kresge Building,
Room K201, London, Ontario, Canada, N6A 5C1
Ph: 519-435-1252, Fax: 519-661-3766
(susan.muir@uwo.ca).

In order to ensure that older adults with cognitive impairment have access to services that are beneficial to recovery of full function, improve quality of life and offset transfer to long term care, there is a need to contextualize and quantify the magnitude of functional recovery. Benefits to the successfully rehabilitated patient may include the ability to return to their own home, improved quality of life both for the patient and caregiver, and overall lessened care-giving requirements that are not apparent using a qualitative descriptor like “poorer functional outcome” made relative to the cognitively intact.³⁰

The purpose of this systematic review was to evaluate the literature on the inpatient rehabilitation outcomes in older patients with cognitive impairment following surgical repair of a femoral neck fracture. The primary aim was to describe rehabilitation outcomes in terms of functional activity, length of stay, and discharge destination. A secondary aim was to investigate the components of effective physical therapy treatment during inpatient rehabilitation. The findings of the review would be summarized using Sackett’s levels of evidence and grades of recommendations.

METHODS

Search Strategy and Selection Criteria

A detailed literature search was conducted to identify articles published in the English language between 1990 and June 2007 evaluating rehabilitation treatment for the post-surgical repair of a hip fracture in people that have cognitive impairment. The search strategy was developed and conducted in collaboration with a health science librarian. The following electronic databases were searched: MEDLINE, EMBASE, CINAHL, PsycINFO, Cochrane Library (Cochrane Database of Systematic Reviews, Database of Abstracts of Reviews of Effectiveness, and Cochrane Controlled Trials Register). Published lists of Theses and Dissertations (ProQuest Dissertations and Theses Database) and listings by the New York Academy of Science, were searched where possible. The search was performed using the following MeSH and subject terms, and keywords: dementia/Alzheimer disease/cognitive impairment/dementia; vascular/dementia; multi-infarct/dementia; delirium, amnesic, cognitive disorders; hip fracture/femoral fracture; rehabilitation; outcome/outcome assessment/treatment outcomes; and prognosis. An iterative process was used to ensure all relevant articles had been obtained. A further hand search of bibliographic references of extracted articles and existing reviews was also conducted to identify potential studies not captured in the electronic database searches.

Study Inclusion Criteria

One member of the team (SWM) screened abstracts from the initial search and obtained articles deemed potentially relevant. The two authors (SWM and AY) independently evaluated each article to determine if it met the inclusion criteria for full review. After retrieving the full text, an article was considered relevant if it met the following criteria: (1) randomized or nonrandomized (prospective) study design; (2) study population of older adults, 60 years or older, postsurgical repair of hip fracture; (3) focus of study was inpatient rehabilitation after the surgical repair with functional assessment before and after rehabilitation; and (4) included assessment of cognition

with the functional outcome evaluated in terms of cognitive status. Study inclusion was not limited to studies of only people with cognitive impairment in the sample. Additionally, studies that reported both acute and chronic cognitive impairment in the sample populations were eligible for the systematic review. Studies that have determined risk factors for functional outcome only without a reference to rehabilitation treatment were excluded from the review. In addition, we have excluded publications types without primary data, for example, letters and case studies.

Methodological Quality Assessment

Reviewers did an independent and blinded assessment of the methodological quality of the articles extracted using the Downs and Black rating scale.³⁴ The Downs and Black rating scale is a validated and reliable instrument for evaluating both randomized and nonrandomized studies. The rating scale has 27 questions grouped into 5 sections: reporting, external validity, internal validity – bias, internal validity – confounding, and power. The aggregated maximum possible score is 32 with a higher score indicating greater methodological quality. If rating discrepancies occurred, the 2 reviewers resolved differences by consensus.

Data Extraction

Articles selected for full review had the following information extracted: authors, place and date of publication, study design, sample size and percentage of total sample that are female, mean age, rehabilitation setting, cognitive and functional assessment methods, rehabilitation intervention (Table 1). The inclusion and exclusion criteria for the selected articles are listed in (Table 2). In addition, the following information was gleaned to aid interpretation of the review: admission criteria for rehabilitation from acute care hospital, place of residence pre-fracture, and type of hip fracture, length of stay, and time points for assessment.

Formulating conclusions based on levels of evidence

Sackett’s hierarchical levels of evidence and grades of recommendations were used in formulating and summarizing the findings of the systematic review. There are 5 levels of evidence and 3 grades of recommendations:³⁵ Level I – large randomized trials with clear-cut results, Grade A recommendations; Level II – small randomized trials with uncertain results, moderate to high risk of error, Grade B recommendations; Level III – nonrandomized, contemporaneous controls, Grade C recommendations; Level IV – nonrandomized, historical controls, Grade C recommendations; Level V – no controls, case-series only, Grade C recommendations. The levels of evidence and grades of recommendation are based on susceptibility to bias of study designs and reflect the extent to which the reader of the article can be confident that an estimate of effect is correct.³⁶ The grade of recommendation, also termed the strength of recommendation, reflects not only the level of evidence but also the quality of the study and the generalizability of the results in making inferences to patient populations. In intervention research, randomized controlled trials are considered the ideal study design for demonstrating efficacy as they are less prone to bias than nonrandomized trials and thus receive the highest

Table 1. Summary of Studies Meeting the Selection Criteria for Inclusion in the Systematic Review

Author	Study Design	Sample Size (% female)	Mean Age in Years (SD) [range]	Rehabilitation setting	Cognitive Assessment Measure	Functional Outcome Measure	Rehabilitation Intervention Described
Adunsky et al 2003 ³⁷ USA	Prospective cohort	320 (76%)	Geriatric ward: 81.9 (6.7) [65 - 97] Usual care: 80.0 (7.1) [67 - 97]	Specialty geriatric ward for hip fracture patient versus usual care.	FIM cognitive	FIM motor	Multidisciplinary. Only number of sessions and total hours per week by physical and occupational therapy detailed.
Bellini et al, 2007 ³⁸ Italy	Prospective cohort	80 (90%)	80.4 (7.3) [68 - 97]	Inpatient geriatric rehabilitation program.	MMSE GDS	Barthel Index and the number of rehabilitative procedures.	Multidisciplinary. Only number of sessions and total hours per week by physical and occupational therapy detailed.
Goldstein et al, 1997 ³⁹ USA	Prospective cohort	58 (83%)	84.0 (6.7) [71 - 99]	Inpatient geriatric rehabilitation hospital plan.	MDRS	FIM motor	No details provided.
Heruti et al, 1999 ⁴⁰ Israel	Prospective cohort	204 (76.5%)	80.0 (7.1) [65 - 97]	Inpatient Geriatric Rehabilitation Unit.	MMSE	FIM motor	Multidisciplinary No details provided.
Horgan et al, 2003 ⁴¹ Ireland	Prospective cohort	59 (92%)	80 (interquartile range = 73-87)	Acute care hospital post-surgical repair of hip fracture.	AMTS	EMS	Time to physical therapy referral and specific treatment intervention options provided.
Huusko et al, 2000 ⁴² Finland	Randomized controlled trial	243 (72%)	Intervention: 80 [67 - 92] Control: 80 [66 - 97]	Intervention group: geriatric ward in hospital where all surgeries were performed. Control group: Usual care discharge to local hospitals.	MMSE	Place of residence at 3 and 12 months after surgery.	Detailed rehabilitation protocol described for each group. No detailed information on rehabilitation interventions.
Lenze et al, 2004 ⁴³ USA	Prospective cohort	57 (77%)	80.3 (8.5) [64-94]	Rehabilitation hospital.	MMSE	FIM motor	No details provided.
Lenze et al, 2007 ⁴⁴ USA	Prospective cohort	97 (81.4%)	81.7 (8.8)	Acute care hospital.	MMSE	FIM motor	No details provided.
Moncada et al, 2006 ⁴⁵ USA	Prospective cohort	48 (66%)	Cognitively impaired: 78 Cognitively intact: 79	Acute care hospital.	MMSE CAM GDS	BADL IADL	No details provided.
Rolland et al 2004 ⁴⁶ France	Prospective cohort	61 (82%)	84.59 (7.8) [70 - 101]	Inpatient geriatric rehab unit.	MMSE	FIM	No details provided.
vanDortmont et al 2000 ⁴⁷ Netherlands	Prospective cohort	202 (83%)	Cognitively impaired: 84 [71 - 96] Cognitively intact: 82 [70 - 99]	Acute hospital stay.	DSM-III-R CST-14	Place of residence ADL	No details provided.

N/A, not available; FIM, Functional Independence Measure; FIM cognitive, Functional Independence Measure cognitive subscale; FIM motor, Functional Independence Measure motor subscale; MMSE, Mini-mental State Examination; GDS, Geriatric Depression Scale; MDRS, Mattis Dementia Rating Scale; AMTS, Abbreviated Mental Test Scale; CAM, Confusion Assessment Method; DSM-III-R, Diagnostic and Statistical Manual of Mental Disorders, 3rd ed.; CST, Cognitive Screening Test; EMS, Elderly Mobility Scale; ADL, activities of daily living; BADL, Basic activities of daily living and IADL, instrumental activities of daily living.

Table 2. Summary of Study Sample Populations

Author	Study inclusion criteria	Study exclusion criteria	Percentage of eligible patients enrolled
Adunsky et al 2003 ³⁷	- ≥ 65 years of age - Admission after pertrochanteric or subcapital hip fracture - stable medical status enabling active rehabilitation treatment`	- rehabilitation period shorter than 7 days - presence of other acute disabilities (ie, multiple trauma) - postoperative unstable fractures - medical conditions preventing active rehabilitation - transfer to acute-care departments as a result of complications - death	95% (320/336)
Bellini et al 2007 ³⁸	- primary diagnosis of surgery for hip fracture	- hip fracture result of multiple trauma - recurrent hip fracture - pathological fracture due to cancer - life threatening conditions (ie, acute myocardial infarction, coma or terminal cancer)	49.7% (80/161) - details on reasons for participants not included in study presented

Table 2. Continued

Goldstein et al 1997³⁹	- ≥ 65 years of age - transfer to rehabilitation unit following hip fracture repair	- persistent post-operative confusion - a history of early childhood learning difficulties - hip fractures due to multiple trauma	- number of eligible subjects not reported - 58 included in study
Heruti et al 1999⁴⁰	- admission after repair of subcapital or peritrochanteric hip fracture	- presence of other acute disabilities	91% (204/224)
Horgan et al 2003⁴¹	- ≥ 65 years of age - hip or upper femoral fracture	Not specified	79.9% (59/74) - details on reasons for participants not included in study presented
Huusko et al 2000⁴²	- ≥ 65 years of age - living independently in the community and able to walk unaided prior to fracture	- pathological fractures - serious early complications - patients receiving calcitonin treatment - terminally ill patients	41% (243/591)
Lenze et al 2004⁴³	- ≥ 60 years of age - transfers from acute care hospital after surgery to repair hip fracture - primary diagnosis of hip fracture - able to provide informed consent	Not specified	65% (57/88)
Lenze et al 2007⁴⁴	- ≥ 60 years of age - transfers from acute care hospital after surgery to repair hip fracture - able to provide informed consent - free of metastatic cancer	Not specified	70% (97/139)
Moncada et al 2006⁴⁵	- hip fracture due to osteoporosis	- hip fracture due to high impact or pathological causes	- number of eligible subjects not reported - 48 included in study
Rolland et al 2004⁴⁶	- ≥ 70 years of age - hospitalized for rehabilitation after hip fracture surgery - able to walk 10m without use of gait aid prior to fracture - free at baseline of other acute disease (ie, another orthopaedic surgery)	- severe symptomatic arthritis - severe cardiac or pulmonary disease, depression, neurological conditions (ie, Parkinsons disease, polyneuropathy, stroke)	- number of eligible subjects not reported - 61 included in study
vanDortmont et al 2000⁴⁷	- ≥ 70 years of age - displaced (Garden III/IV) hip fracture of the femoral neck treated with hemiarthroplasty	Not specified	- number of eligible subjects not reported - 202 included in study

level of evidence. The use of a standardized tool for rating the quality of the studies allows for assigning a grade of recommendation uniformly across included studies.

RESULTS

Study Characteristics

A total of 267 abstracts were identified as potentially relevant based on the key search terms and the hand search of bibliographic references. After the initial screening of abstracts, 49 full text articles were retrieved for detailed analysis. (Figure 1) A total of 11 articles met the inclusion criteria, 1 randomized controlled trial (RCT) and 10 nonrandomized prospective cohort series. Details of the findings from these 11 studies are presented in Table 1. The Downs and Black scores from the methodological evaluation³⁴ are presented in Table 3. The Downs and Black total score for the RCT was 19 and the average score of the 10 cohort studies was 14.7 (range 10 to 19).

Participant Population

Details about each study's inclusion/exclusion criteria and the percentage of eligible patients who participated in the

study are presented in Table 2. Eight of the eleven studies reported using consecutive admissions to the medical service in the study.^{37,38,40,41,43-46} Six studies reported the number of patients eligible for the study and the subsequent number who met study inclusion/exclusion criteria at the start of the study, though the exact reasons for exclusion were not fully reported in all studies. Inclusion rates vary widely from 95%³⁷ and 91%⁴⁰ to the very low values of 49.7%³⁸ and 41%.⁴² Huusko et al⁴² had the lowest reported inclusion rate and the authors did not report reasons for participant exclusion, a finding that creates less confidence with the study's findings. High rates of eligible subject nonparticipation, particularly when reasons for exclusion are not presented, can lead to significant selection bias which impacts the generalizability of the results.

Rehabilitation Setting

Multiple settings for inpatient rehabilitation care were evaluated in the articles: acute postsurgical care on a general orthopaedic ward^{40,43,46} and a specialized hip fracture service,³⁷ stand alone rehabilitation hospitals,^{37,38,42,45} and specialized geriatric rehabilitation units within a tertiary care hospital.^{37,39,41}

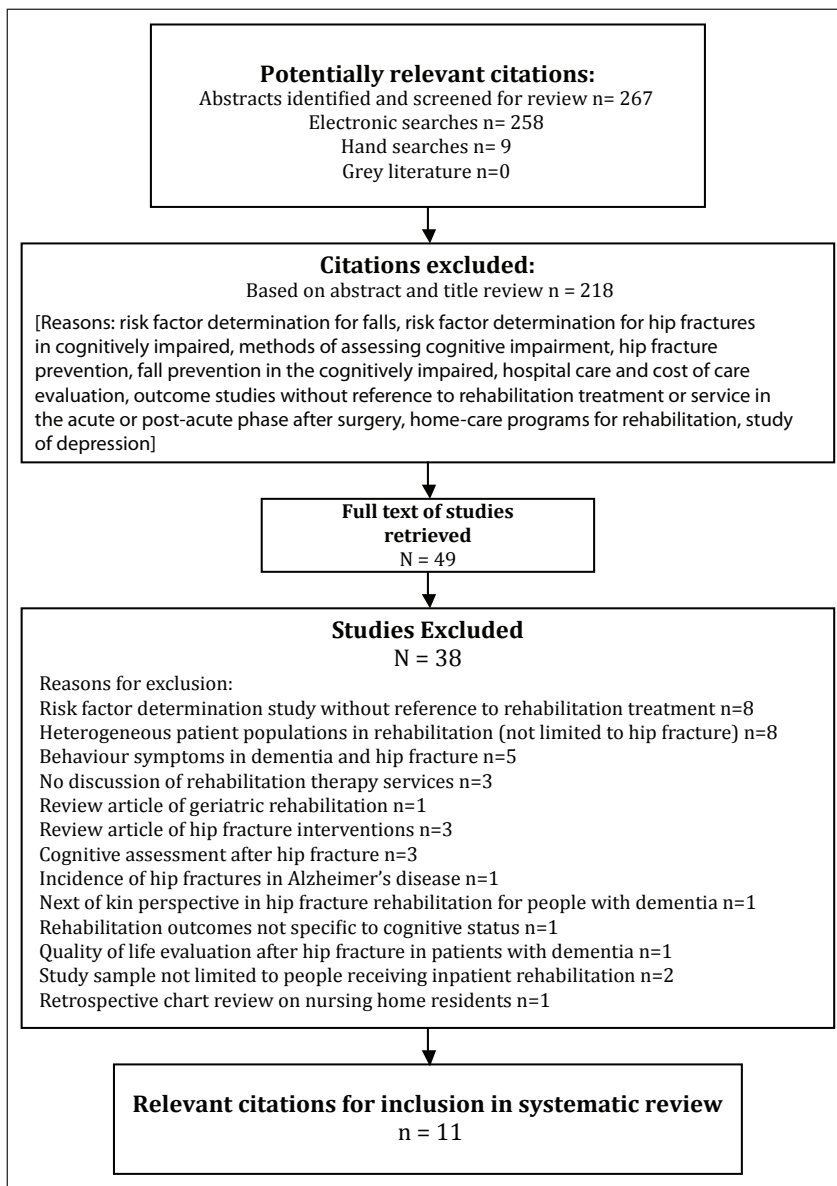


Figure 1. Flowchart of the literature search.

Table 3. Assessment of Methodological Quality of the Studies included in the Systematic Review

Methodological Quality Scores (values)						
Study	Reporting (10)	External Validity (3)	Internal Validity – Bias (7)	Internal Validity – Confounding (6)	Power (5)	Total (32)
Adunsky et al 2003 ³⁷	9	3	4	3	0	19
Bellini et al 2007 ³⁸	8	2	4	1	0	15
Goldstein et al 1997 ³⁹	7	2	3	1	0	13
Heruti et al 1999 ⁴⁰	7	3	3	3	0	16
Horgan et al 2003 ⁴¹	5	3	3	1	0	12
Huusko et al 2000 ⁴²	7	3	4	5	0	19
Lenze et al 2004 ⁴³	6	2	3	3	0	14
Lenze et al 2007 ⁴⁴	6	3	3	2	0	14
Moncada et al 2006 ⁴⁵	5	0	3	2	0	10
Rolland et al 2004 ⁴⁶	8	3	4	3	0	18
vanDortmont et al 2000 ⁴⁷	7	3	3	3	0	16

Three studies compared outcomes between 2 rehabilitation settings: 2 medical care models within the same acute care hospital,³⁷ inpatient rehabilitation facilities versus skilled nursing facilities,⁴⁴ and the randomized treatment to a geriatric ward in a tertiary care hospital or usual care in the local community hospital after surgery.⁴² The other studies followed cohorts of consecutive admissions to a single service.^{38-41,43,45-47}

Only one study included the selection criteria used at the acute care hospital for referral and transfer to an inpatient rehabilitation facility.³⁹ This study acknowledged a selection bias of choosing people who were felt would achieve a significant benefit from rehabilitation, were able to participate in therapy, and with a reasonable discharge plan in place prior to entering rehabilitation. The extent of the selection bias in the other studies is unknown and limits the generalizability of the findings.

Cognitive Impairment Assessment

Cognitive impairment was evaluated by multiple scales (Table 1). Additional measures included in these studies were depression measured using the Geriatric Depression Scale (GDS), severity of depression assessed using the Hamilton Depression Rating scale (Ham-D), and delirium using the Confusion Assessment Method (CAM).

The Mini-mental State Examination (MMSE) was the most common scale, being used in seven studies.^{38,40,42-46} The threshold score of the MMSE to indicate impairment was not consistent in these studies, making comparison of outcomes across studies difficult. Comparison of outcomes across all studies was difficult due to the use of different scales and thresholds to define the patients with cognitive impairment. A non-uniformity of the case definition for cognitive impairment can create dissimilar

samples that impact the ability to compare findings between studies and to generalize study findings.

Additionally, none of the studies qualified cognitive status based on the timing of the diagnosis of cognitive impairment, for example pre-fracture dementia or postoperative delirium. Acute cognitive changes, for example delirium, may resolve over the inpatient rehabilitation time frame with subsequent improvement in function that may more closely resemble functional gains of people without cognitive impairment. Prefracture cognitive impairment indicates a chronic nature of the condition that may be exacerbated with the acute injury and not associated with an expectation of improvement in status over time. Three studies re-evaluated cognitive status at the end of the rehabilitation period,^{37,41,47} though data was not used to evaluate whether cognitive status changed over the duration of rehabilitation.

Functional Activity

Several outcome measures were used: the Functional Independence Measure (FIM) as an aggregate score of the 2 subscales for motor function and cognitive function, and the motor subscale alone; the Barthel Index (BI); and the Elderly Mobility Scale (EMS). Six studies used the FIM making it the most common scale, 5 using the motor subscale alone and one study using the aggregate score.^{37,39,40,43,44,46} Derivations from the FIM score, specifically the FIM gain, FIM efficiency, Montebello Rehabilitation Factor Score (MRFS) efficiency and efficacy, were used in data analyses of these studies to quantify the magnitude of the rehabilitation effect. Activities of daily living (ADL) were used in 2 studies to evaluate function^{45,47}, but only Moncada et al⁴⁵ used a valid and reliable tool.

Seven studies have reported that patients with cognitive impairment were able to make functional gains after the inpatient rehabilitation.³⁹⁻⁴⁵ Absolute gains in function, the difference between the discharge and admission scores, were equal for impaired and nonimpaired. The relative gains, which take into account length of stay and a patient's specific potential for change based on the maximum possible FIM score the person can achieve creates a value from 0 to 1, were smaller in the cognitively impaired. The relative scores overcome a ceiling effect in high functioning individuals as their absolute gain is limited compared to the gain of individuals with a lower score.³⁷

Two studies reported a definition for "successful rehabilitation," though only one was specified a priori,⁴⁰ using an MRFS efficacy ≥ 0.50 , or at least a 50% improvement in function after hospital admission.^{37,40} The first study by Adunsky et al,³⁷ "successful rehabilitation" was evaluated by admission FIM-cog scores divided into bands at 5-23, 24-32, and 33-35. The asymmetry of the score bands, post hoc analysis and lack of a threshold score for cognitive impairment make the interpretation of the results very challenging especially to translate the findings into clinical practice. The study by Heruti et al⁴⁰ demonstrated absolute gains in function were independent of cognitive status though relative gains were less in patients with cognitive dysfunction ($p < 0.001$).

Referencing ADL function to ability one month prior to the fracture, the total number of independent ADLs decreased from 5.4 to 3.8 at 6 weeks postsurgery, a statistically significant effect, $p < 0.001$, that was independent of cognitive status.⁴⁵ Unfortunately, this study only looked at short-term outcomes and did not follow up participants for a sufficient time frame to evaluate recovery of

function. vanDortmont et al⁴⁷ found the majority of patients were independent in ADLs at the end of rehabilitation. However these results need to be viewed with caution as the measurement tool has not been adequately tested for reliability or validity as a measure of ADL function for older people and there was no statistical analysis accompanying this result.

Length of Stay (LOS)

Discharge criteria to determine attainment of maximal function during rehabilitation was reported in only one study.⁴⁶ Four studies reported LOS by cognitive status while 5 studies reported a combined average LOS for all study participants. Three studies reported no significant difference in the average LOS between cognitively impaired and intact groups during the acute hospital stay.^{41,45,46} The average LOS in the acute hospital setting prior to transfer to an inpatient rehabilitation facility varied widely from 6.6 days,⁴⁵ 16 days,⁴¹ and 84.5 days⁴⁶ respectively.

In the subacute rehabilitation phase, a statistically significant decrease in LOS was found for mild and moderately cognitively impaired participants in the intervention group of the RCT.⁴² The LOS ranged from 29 to 47 days in the intervention group to a range of 46 to 147 days in the control group. The median MMSE scores showed a statistically significant difference between the intervention and control groups at 23 versus 20, $p < 0.001$, even though subjects were randomly allocated into the groups. Results are conflicting for studies following a case-series through a single rehabilitation model. Rolland et al⁴⁶ found no statistically significant difference in average LOS across 3 cognitive groups with values ranging between 47.7 to 66.2 days for inpatient subacute rehabilitation. In contrast, Moncada et al⁴⁵ found a statistically significant difference, $p < 0.001$, in the LOS. Patients with cognitive impairment had a longer LOS at 18 days compared to patients who were cognitively intact at 10 days during the acute postoperative period. The lack of standardized discharge criteria from rehabilitation for all studies meant we were unable to make direct comparison of results across studies.

Discharge Destination

Place of residence upon discharge was another outcome measure included in 3 studies.^{39,42,47} These studies focused on the ability of participants residing independently in the community pre-fracture to return to community living upon discharge from rehabilitation. Only one study limited participation entirely to community dwelling elderly.⁴² Goldstein et al³⁹ had a heterogeneous population comprised of people who resided in the community, personal care homes, intermediate nursing facilities, and nursing home. The study by vanDortmont et al⁴⁷ contained community dwelling older adults in the cognitively intact group while 92.3% of the small cognitively impaired group came from psychogeriatric institutions. In the study by Huusko et al,⁴² a greater percentage of the cognitively impaired patients receiving the structured inpatient rehabilitation program returned to community living, 91%, compared to the control group, 63%. The other studies included in this review did not report the place of residence prior to fracture for the study participants.^{37,38,40,41,43-46}

Rehabilitation Interventions

No detailed information about the rehabilitation interventions was included in the studies.⁴³⁻⁴⁷ The most common

practice was to report the number of hours of rehabilitation that patients received per day or per week.³⁷⁻³⁹ Only one study reported on weight bearing status of participants postsurgery and specifically included the provision that if patients were unable to adhere to weight bearing restrictions than they would be allowed mobilization without restriction.⁴² Cognitive impairment was found to negatively influence the ability of individuals ability to participate in rehabilitation sessions either through a reduction in the total number of sessions or in the level of participation in each session.^{38,43} However, there is not enough evidence or information to guide selection and inclusion of specific physical therapy rehabilitation interventions to optimize outcomes in this patient population.

Level of Evidence Recommendations

After the surgical repair of a hip fracture, patients with mild to moderate cognitive impairment benefit from participation in a multidisciplinary inpatient rehabilitation program was assigned a Grade B recommendation.⁴² The more general statement that people with cognitive impairment demonstrate functional gains in the acute and subacute phases of an inpatient rehabilitation program though with possible longer length of stay merits a Grade C recommendation.^{39-41,43-45} No recommendations can be made specific to physical therapy interventions as the literature does not provide sufficient detail.

DISCUSSION

The methodological quality of studies included in this systematic review was fair to poor. The levels of evidence rating derived from the studies included in this systematic review must be interpreted with caution due to the low methodological quality of the studies. The recommendations are primarily derived from the study by Huusko et al,⁴² and there are conflicting opinions in the literature about the quality of recommendations that can be obtained from the study. A recent systematic review of physical therapy interventions in hip fracture rehabilitation assigned this study's results a Grade A recommendation,⁴⁷ while the Cochrane Review on inpatient rehabilitation for proximal femoral fractures in older adults had significant concerns and felt the subgroup analysis by cognitive status was inappropriate.⁴⁹ The present Grade B level of recommendation takes into consideration the possibility of moderate to high risk of error in the study results as outlined by the Cochrane review. There is consistent Grade C evidence to support the more general recommendation that patients with cognitive impairment can demonstrate functional gains during inpatient rehabilitation.^{39-41,43-45}

Comparison across studies is limited by the heterogeneity of the samples and clinical measures used to assess both cognitive status and functional ability. In the assessment of cognitive status, the use of multiple scales and multiple threshold values created problems in identifying the study population with cognitive impairment. Previous research has demonstrated the choice of diagnostic system has a dramatic impact on the prevalence estimates of dementia.⁵⁰ This heterogeneity does not allow for any certainty that the same patient populations are being designated as cognitively impaired between studies thereby limiting the generalizability of the findings or the ability to make firm recommendations.

There are conflicting findings for the impact of cognitive status on the length of stay in a subacute inpatient rehabilitation program. Potential sources for this variation include the lack of defined discharge criteria, uncertainty that the study samples have patients with similar levels of cognitive impairment and potential differences in clinical practice between countries. Greater information was required from these studies on the criteria used to discharge people from rehabilitation.

Regardless of the cognitive status of older adults following surgery for a hip fracture, there is limited evidence from the literature supporting coordinated multidisciplinary inpatient rehabilitation.^{48,49,51} Considering the high prevalence of cognitive impairment in this population,¹⁵ this subgroup of patients represents an area with great potential and need for further research. Specifically there is a need to identify patient characteristics and treatment interventions that lead to successful outcomes and address the cognitive and behavioural symptoms that can create barriers to rehabilitation. There is also a need to increase attention to the prevention of acute cognitive changes, such as delirium, as even transient acute cognitive changes can increase the risk of poorer functional outcomes.¹⁵ Additionally, the timing of onset of cognitive changes is important from both a research and clinical perspective. Importantly acute cognitive changes may resolve over the time frame a patient is receiving inpatient rehabilitation such that cognitive ability after surgery may not reflect potential functional outcomes.

None of the included studies supplied sufficient detail to allow for the evaluation of specific rehabilitation interventions, their frequency with respect to prescriptive information on the number of repetitions of a given exercise or the frequency of performing the exercise over a week duration, duration or progression. Future research is required to define the specific rehabilitation interventions that successfully overcome the cognitive and behavioural symptoms that impact the ability of this population to participate optimally in rehabilitation interventions. Treatment approaches that are successful in the cognitively intact may be unsuccessful in the cognitively impaired, so more specific information about interventions and modifications that are employed at the program level as well as at the physical therapy level merit further investigation. It is also difficult to isolate the independent contribution of a single intervention, eg, physical therapy treatment, from other disciplines within a multidisciplinary program, therefore well-designed studies are need to address this area. Additionally, further research is also required to determine the optimal time frame for recovery to occur, especially if rehabilitation is on a trial basis;⁵² the clinical significance of gains with respect to care needs for the individual and caregivers; and the maintenance of functional gains upon discharge from rehabilitation.

Additional areas for improvement in future research identified from this systematic review include a complete reporting of both inclusion and exclusion criteria for study participants as well as a demographic, and pre-fracture cognitive and physical function of all participants. Importantly there needs to be standardization of cognitive assessment, both for the method used and the threshold values used to denote impairment to allow comparison across studies. The assessment of cognition also needs to take into account the timing of the diagnosis and any change in the cognitive status from pre-fracture levels.

A clear identification of criteria used at the acute hospital stage for referral to and acceptance into inpatient rehabilitation is needed. The potential selection bias of picking only the best possible candidates will over-estimate treatment effects and a lack of criteria used on this issue limits fully describing the characteristics of people who will and will not benefit from rehabilitation. Pre-fracture place of residence of patients is important information as discharge destination is not an informative outcome if a change in status cannot be determined. Additionally, people living in supported accommodation or institutional setting represent a more frail population with possibly limited potential to make gains in function compared to people who were living in the community pre-fracture.

Weight bearing status may impact the ability to make functional gains and may increase length of stay if these restrictions directly impact a person's ability to safely return home regardless of cognitive status. Additionally, the cognitively impaired may be particularly challenged to mobilize with weight bearing restrictions. Therefore, it is important to include information on the type of fracture, type of fixation, weight bearing restrictions, co-morbid medical conditions and provisions that will facilitate mobilization if a person is unable to adhere to or physically unable to manage mobilizing with less than full weight bearing status.

There are several limitations in this systematic review. First, randomized controlled trials are considered the primary means of demonstrating treatment efficacy and this systematic review found only one RCT.⁴² The strength of recommendations derived from this study is limited due to concerns about the data analysis for the subgroup of cognitively impaired patients. Second, the majority of studies supporting inpatient rehabilitation after hip fracture in the cognitively impaired are prospective case series and provide limited evidence to support efficacy. Further limitations may include small sample sizes and poor methodological quality of the studies which highlight the need for further research.

CONCLUSIONS

Due to the limitations in the studies identified for this systematic review the recommendations should be regarded with caution. The first recommendation is that cognitively impaired older patients with hip fracture are most likely to demonstrate gains in function from participation in an inpatient rehabilitation program in the acute and subacute recovery phases after surgery. Second, group participation in an inpatient rehabilitation program for the cognitively impaired may require a longer length of stay compared to the cognitively intact which is offset by the benefit that more cognitively impaired older adults might be able to return to community living after this type of intervention. Third, our findings highlight the need for well-designed clinical trials adequately powered to detect clinically meaningful results with valid outcome measures to improve care for this patient group.

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