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ORIGINAL REPORT

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

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Objective: **To investigate the short- and long-term effects of a multidisciplinary postoperative rehabilitation programme in patients with femoral neck fracture.**

Design and Subjects: **A randomized controlled trial in patients (n = 199) with femoral neck fracture, aged ≥ 70 years.**

Methods: **The primary outcomes were: living conditions, walking ability and activities of daily living performance on discharge, 4 and 12 months postoperatively. The intervention consisted of staff education, individualized care planning and rehabilitation, active prevention, detection and treatment of postoperative complications. The staff worked in teams to apply comprehensive geriatric assessment, management and rehabilitation. A geriatric team assessed those in the intervention group 4 months postoperatively, in order to detect and treat any complications. The control group followed conventional postoperative routines.**

Results: **Despite shorter hospitalization, significantly more people from the intervention group had regained independence in personal activities of daily living performance at the 4- and 12-month follow-ups; odds ratios (95% confidence interval (CI)) 2.51 (1.00–6.30) and 3.49 (1.31–9.23), respectively. More patients in the intervention group had also regained the ability to walk independently indoors without walking aids by the end of the study period, odds ratio (95% confidence interval) 3.01 (1.18–7.61).**

Conclusion: **A multidisciplinary postoperative intervention programme enhances activities of daily living performance and mobility after hip fracture, from both a short-term and long-term perspective.**

Key words: activities of daily living, elderly, hip fracture, intervention, rehabilitation.

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INTRODUCTION

A hip fracture is a common reason for being institutionalized among elderly people (1–3) as it is associated with difficulties in performing activities of daily living (ADL) (4) and a decline in mobility (5). A recently published cross-sectional population-based study found that a history of a hip fracture was associated with poorer personal ADL (P-ADL) performance and poorer mobility (6).

To improve the health situation for elderly people, Comprehensive Geriatric Assessment (CGA) and management can be used to determine the person's medical, functional and psychosocial needs (7). A meta-analysis has found that CGA programmes are effective in enhancing survival and function in elderly people (8).

Rehabilitation programmes with co-ordinated multidisciplinary or geriatric care after hip fracture surgery do not have a homogeneous outcome and there is no conclusive evidence of their effectiveness (9). The results obtained are conflicting, and as the programmes have different study designs, inclusion criteria and methods of assessment, it is difficult to compare them (10–19). Regarding functional recovery, there are some studies that show significant effects early on after the hospital stay (10, 14, 16, 19), but from a longer perspective there is only one trial that has shown significant effects (18). This trial demonstrated an increased P-ADL performance in the intervention group 12 months after surgery.

The aim of the present randomized controlled study was to investigate the short- and long-term effects of a multidisciplinary postoperative rehabilitation programme among patients with femoral neck fracture regarding living conditions, walking ability and ADL performance. A secondary aim was to investigate outpatient rehabilitation consumption and inpatient days after discharge and mortality.

METHODS

Recruitment and randomization

This study included patients with femoral neck fractures aged 70 years or older, consecutively admitted to the orthopaedic department at Umeå University Hospital, Sweden, between May 2000 and December 2002. In Sweden different surgical methods are used depending on the displacement of the femoral neck fracture. In the present study patients with undisplaced fracture were operated on using internal fixation and patients with displaced fracture were operated on using hemi-arthroplasty. If patients had severe rheumatoid arthritis, severe hip osteoarthritis or pathological fracture they were excluded by the

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surgeon on duty because of the need for a different surgical method, such as total hip arthroplasty. Patients with severe renal failure were excluded by the anaesthetist because of their morbidity. Patients who were bedridden before the fracture occurred were also excluded.

In the emergency room the patients were asked both in writing and orally if they were willing to participate in the study, which included a 4- and 12-month' follow-up. The next of kin was always asked prior to the inclusion for patients with cognitive impairment. The patients or their next of kin could withdraw participation at any time during the study. A total of 258 patients met the inclusion criteria, 11 patients declined to participate and 48 patients were not invited to participate because they had sustained the fracture in the hospital, or because the inclusion routines failed (Fig. 1). These 59 patients were more likely to be men ($p = 0.033$) and living in their own house/apartment ($p = 0.009$), but there was no difference in age ($p = 0.354$) compared with the participating patients. The remaining 199 patients (Table I) consented to participate. All patients received the same preoperative treatment at the orthopaedic department.

Patients were randomized to postoperative care in a geriatric ward with a special intervention programme or to conventional care in an orthopaedic ward, using opaque sealed envelopes. The lots in the envelopes were numbered sequentially. All participants received this envelope while in the emergency room, but it was not opened until immediately before surgery to ensure that all received similar preoperative treatment. The selection procedures were carried out by people not involved in the study.

The randomization was stratified according to the operation methods used in the study. Depending on the degree of dislocation the patients were treated with 2 hook-pins (Swemac Ortopedica®, Linköping, Sweden) ($n = 38$ intervention vs $n = 31$ control) or with bipolar hemiarthroplasty (Link®, Hamburg, Germany) ($n = 57$ vs 54). Basocervical fractures ($n = 7$ vs 10) were operated on using a dynamic hip screw (DHS, Stratec Medical®, Oberdorf, Switzerland) and one patient had a resection of the femoral head due to a deterioration in medical status and one died before surgery (both were in the control group).

Intervention

The intervention ward was a geriatric unit specializing in geriatric orthopaedic patients. The staff worked in teams to apply comprehensive geriatric assessments and rehabilitation (7, 20). Active prevention, detection and treatment of postoperative complications, such as falls, delirium, pain, decubital ulcers, and malnutrition, were systematically implemented daily during the hospitalization. Early mobilization, with daily training, was provided by physiotherapists, occupational therapists and care staff during the hospital stay. A geriatric team, including a physician, assessed the patients 4 months postoperatively to detect and treat any complicating disorders and to determine further rehabilitation needs. The staffing ratio in the intervention ward was 1.07 nurses or aides per bed.

The control ward was a specialist orthopaedic unit following conventional postoperative routines. A geriatric unit, specializing in general geriatric patients, was used for those who needed longer rehabilitation ($n = 40$), but such patients were not admitted to the same ward as that used for the intervention. The staffing at the orthopaedic unit was 1.01 nurses or aides per bed and 1.07 for the geriatric control ward. The main content of the intervention programme and the conventional care are described in Table II.

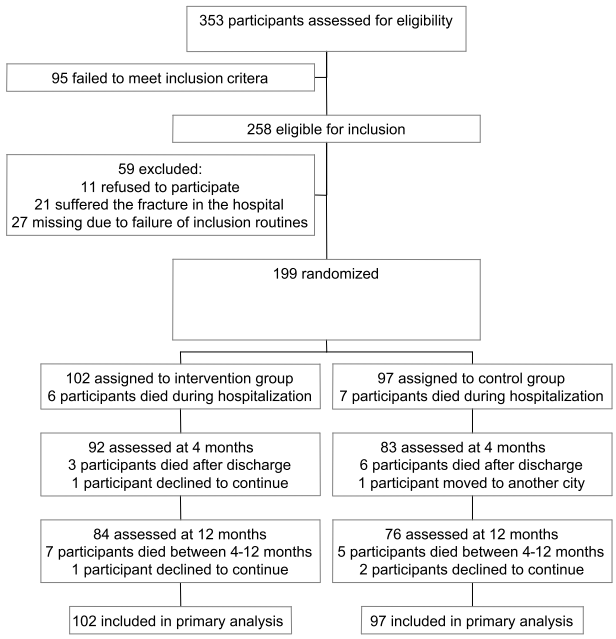

Fig. 1. Randomized trial.

Table I. *Basic characteristics and assessments during hospitalization among participants, intervention and control groups. If details are not given for the complete group, the number of subjects is given in parentheses.*

	Intervention ($n = 102$)	Control ($n = 97$)	p-value
Sociodemographic			
Age, mean (SD) (years)	82.3 (6.6)	82.0 (5.9)	0.724
Females, *n*	74	74	0.546
Health and medical problems, *n*			
Cancer	15	14 ($n = 92$)	0.921
Stroke	29	20 ($n = 93$)	0.265
Dementia	28	36	0.145
Previous hip fracture	16	14 ($n = 96$)	0.829
Diagnosed depression	33	45 ($n = 95$)	0.031
Diabetes	23	17 ($n = 95$)	0.417
Cardiovascular disease	57 ($n = 101$)	53 ($n = 93$)	0.938
Medications on admission			
Number of drugs, mean (SD)	5.8 (3.8)	5.9 (3.6)	0.867
Antidepressants, *n*	29	45	0.009
Calcium/vitamin D, *n*	12	16	0.337
Sensory impairments, *n*			
Impaired hearing	42 ($n = 94$)	34 ($n = 82$)	0.667
Impaired vision	37 ($n = 91$)	27 ($n = 74$)	0.584
Functional performance before fracture, *n*			
*Previous falls, last month	24 ($n = 99$)	25 ($n = 90$)	0.580
S-COVS, need for assistance, median (Q_1,Q_3) ($n = 101/94$)	6 (5–7)	5.5 (5–7)	0.749
Staircase of ADL, median (Q_1,Q_3) ($n = 92/88$)	5 (1–7.75)	5 (0.25–7)	0.859
Independent in both P-ADL and I-ADL activities	20 ($n = 101$)	22 ($n = 94$)	0.541
Assessments during hospitalization, mean (SD)			
Mini Mental State Examination ($n = 93/90$)	17.4(8.2)	15.7(9.1)	0.191
Organic Brain Syndrome Scale ($n = 94/90$)	10.1(10.8)	12.5(11.4)	0.148
Geriatric Depression Scale ($n = 81/68$)	5.2(3.6)	4.5(3.5)	0.271
Preoperative waiting time in hours†	24.5(17.8)	24.8(15.3)	0.892

*Except for the fall that caused the hip fracture.
†Waiting time from hospital admission to surgery.
ADL: activities of daily living; I: instrumental; P: personal, S-COVS: Swedish Clinical Outcome Variables; Q_1: first quartile (25%); Q_3; third quartile (75%).

Table II. *Main content of the postoperative programme in the different groups.*

	Intervention group	Control group
Ward layout	• Single and double rooms • 24-bed ward, extra beds when needed	• Single, double and 4-bed room • 27-bed ward, extra beds when needed • The geriatric control ward was similar to the intervention ward
Staffing	• 1.07 nurses or aides per bed • 2 full-time physiotherapists • 2 full-time occupational therapists • 0.2 dietician	• 1.01 nurses per bed • 2 full-time physiotherapists • 0.5 occupational therapist • No dietician • Staffing on the geriatric control ward similar to that on the intervention ward
Staff education	• A 4-day course on caring, rehabilitation, teamwork and medical knowledge, including sessions about how to prevent, detect and treat various postoperative complications, such as postoperative delirium and falls	• No specific education before or during the project
Teamwork	• Teams included Registered Nurses, Licensed Practical Nurses, physiotherapists (PT), occupational therapists (OT), a dietician and geriatricians • Close co-operation between orthopaedic surgeons and geriatricians in the medical care of the patients	• No corresponding teamwork was used at the orthopaedic unit • The geriatric ward, where some of the control group patients were cared for, used teamwork similar to that in the intervention ward
Individual care planning	• All team members assessed each patient as soon as possible, usually within 24 hours, to be able to start the individualized care planning • Team planning of the patient's individual rehabilitation process and goals twice a week	• Individualized care planning was used in the orthopaedic unit, but not routinely, as in the intervention ward • At the geriatric rehabilitation unit there was weekly individual care planning
Prevention and treatment of complications	• Investigation as far as possible regarding how and why the patients sustained the hip fracture, through analysing external and internal fall-risk factors • Calcium and vitamin D and other pharmacological treatments for osteoporosis were administered when indicated • Active prevention, detection and treatment of postoperative complications, such as delirium, pain, decubital ulcers, was systematic • Oxygen-enriched air during the first postoperative day and longer if necessary until the measured oxygen saturation was stable • Urinary tract infections and other infections were screened for and treated • If a urinary catheter was used it was discontinued within 24 hours postoperatively • Regular screening for urinary retention, and prevention and treatment of constipation • Blood transfusion was prescribed if B-haemoglobin, g/l, < 100 and < 110 for those at risk of delirium or those already delirious • If the patient slept badly, the reason was investigated and the aim was then to treat the cause	• No routine analysis of why the patients had fractured their hips; no attempt was made systematically to prevent further falls nor was there any routine prescription of calcium and vitamin D • Assessments for postoperative complications were made by checking, for example, for saturation, haemoglobin, nutrition, bladder and bowel function, home situation etc., but these check-ups were not carried out systematically as in the intervention group
Nutrition	• Food and liquid registration was systematically performed and protein-enriched meals were served to all patients during the first 4 postoperative days and longer if necessary • Nutritional and protein drinks were served every day	• No dietician was available at the orthopaedic unit • No routine nutrition registration or protein-enriched meals available for the patients
Rehabilitation	• Mobilization within the first 24 postoperative hours • The training included both specific exercise and other rehabilitation procedures delivered by a PT, OT as well as basic daily ADL performance training, by caring staff • The patients always do as much as they can by themselves before they are helped • The rehabilitation was based on functional retraining with a special focus on fall-risk factors • Home visit by an OT and/or a PT • The PT/OT co-operated with colleagues working in community service for further consultation after the patient was discharged from hospital • All patients were offered further outpatient rehabilitation after discharge • The PT or OT followed up all patients with a telephone call 2 weeks after discharge and a home visit 4 months postoperatively • A physician met the patients 4 months postoperatively to detect and prevent complications • The 4-month follow-up contained of a medication review and treatment of any complications by the physician. The PT and the nurse made an assessment of rehabilitation needs, needs of; assistive devices, environmental modifications, nutritional problems	• Mobilization usually within the first 24 h • The PT on the ward mobilized the patients together with the caring staff • The PT aimed to meet the lucid patients every day • Functional retraining in ADL situations was not always given • The OT at the orthopaedic unit only met the patients for consultation • No home visits were made by staff from the orthopaedic unit • The geriatric control ward had both specific exercise and other rehabilitation procedures delivered by a PT and OT, similar to that given at the intervention ward • No follow-up intervention by a physician at 4 months

ADL: activities of daily living; PT: physiotherapist; OT: occupational therapist.

The staff on the intervention ward were aware of the nature of the study, and the staff working with the control group were informed that a new care programme was being implemented, which was being evaluated on the geriatric ward.

Data collection

Two registered nurses were employed halftime in the study, of whom the one from the orthopaedic department carried out the assessments in the intervention group, and the one from the geriatric department carried out the same assessments in the control group. A physiotherapist (PT), an occupational therapist (OT) and physicians were also employed to collect data during the project. The assessors were aware of the study-group allocation during the study period. Medical, social and functional data were collected from the patients, relatives, staff and medical records on admission and after 4 and 12 months, respectively. Complications during hospitalization were systematically registered from the medical and nursing records.

Walking ability was registered according to one item from the Swedish version (21) of Clinical Outcome Variables (S-COVS) (21, 22). The item has 7 levels, 1 indicating no functional walking ability and 7 indicating normal function, including outdoor obstacles and gait speed. Use of a walking aid was also registered.

The functional status of performing ADL was measured using the Staircase of ADL including the Katz ADL index (23, 24). The scale measures both P-ADL (bathing, dressing, toileting, transfer, continence, and feeding) and Instrumental ADL (I-ADL) (cleaning, shopping, transportation, and cooking), with higher scores indicating greater ADL dependence.

The patients were also assessed and interviewed using the Mini Mental State Examination (25) to check cognitive status. The modified Organic Brain Syndrome (OBS) scale (26) was used to assess cognitive, perceptual, emotional, and personality characteristics, as well as fluctuations in clinical states. Depression before hospitalization was diagnosed after an evaluation of earlier documented diagnoses, and current treatment with antidepressants. During hospitalization, depression was diagnosed according to current treatment with antidepressants and depression screened using the Geriatric Depression Scale (27) in combination with depressive symptoms observed and registered by the OBS scale. The patient's vision and hearing were assessed by their ability to read 3-mm block letters with or without glasses, and their ability to hear a normal speaking voice from a distance of one metre.

The nurses employed by the study performed the assessments during the hospital stay, and on discharge the PT and OT measured functional ability. At 4 months (± 2 weeks) and 12 months (± 1 month) postoperatively the survivors in both groups were followed up in their homes by a nurse, and a PT or an OT working for the study. The same assessments were performed regarding walking ability and ADL performance as during the hospital stay. In connection with the follow-up, the number of outpatient contacts with a PT and/or OT was registered. In the analyses, 5 contacts or more was regarded as an outpatient rehabilitation period. Readmissions and in-hospital days after discharge were also registered at 4 and 12 months, respectively.

A geriatrician, who was unaware of the study-group allocation, analysed all assessments and documentations after the study was finished, to complete the final diagnoses according to the same criteria for all patients.

The ethics committee of the Faculty of Medicine at Umeå University approved the study (§ 00–137).

Statistical analysis

Student's *t*-test, Pearson's χ^2 test and the Mann-Whitney *U* test were used to analyse group differences regarding basic characteristics, some of the primary and secondary outcomes, and hospital complications. A binary logistic regression was used to analyse the odds ratio (OR) of living situation, walking ability and use of walking aids as well as ADL performance related to intervention or control group allocation. These regressions were adjusted for depression and dementia diagnoses before injury (p-value < 0.150) as well as for the baseline situation of every outcome variable, respectively.

RESULTS

Similar proportions of patients in both groups returned to their pre-fracture living situation. Among patients in the intervention group, 81 (84%) were discharged from hospital to the same place of residence as they had had before the fracture compared with 68 (76%) in the control group, $p = 0.132$. At the 4- and 12-month follow-up there were similar proportions of survivors in both groups who had returned to the same residential situation as they had had before the fracture, 73 (79%) in the intervention group vs 65 (78%) in the control group at 4 months, $p = 0.867$, and 67 (80%) in the intervention group vs 57 (75%) in the control group at 12 months, $p = 0.471$.

There was no difference regarding independent walking ability performance between the groups during the follow-up period (Table III). When analysing the whole 7-graded walking ability item according to the S-COVS, 57 patients (62%) in the intervention group and 40 patients (49%) in the control group had regained the same level of walking ability as they had had before the fracture or had improved their level by the 4-month follow-up, $p = 0.081$. Fifty-two patients (62%) vs 40 patients (53%) in intervention and control groups, respectively, had regained the same level of walking ability as they had had before the fracture or had improved their ability at the 12-month follow-up, $p = 0.236$.

More patients in the intervention group walked indoors without walking aids at 12 months (35/84 vs 22/76, OR 3.01, 95% CI 1.18–7.61, adjusted for baseline differences (dementia and depression) and baseline walking ability) (Table III).

The whole Staircase of ADL, including both I-ADL and P- ADL, were at 4-month, median (Q_1,Q_3) 5.5 (3–9) in the intervention group and 6 (4–9) in the control group, $p = 0.465$ and at the 12-month follow-up 5 (3–9) and 6 (4–9) for intervention and control groups, respectively, $p = 0.056$.

Significantly more patients in the intervention group had regained independent P-ADL ability at 4 and 12 months, adjusted for baseline differences (dementia and depression), 35/92 vs 23/83, OR 2.51 (95% CI 1.00–6.30) and 33/84 vs 17/76, OR 3.49 (95% CI 1.31–9.23) respectively (Table III).

On discharge, 47 out of 96 in the intervention group had returned to at least the same ADL performance level as before the fracture, according to the Katz ADL index, compared with 30/89 in the control group, $p = 0.036$. At 4 months the figures were 56/92 in the intervention group and 39/82 in the control group, $p = 0.078$ and at 12 months 49/84 compared with 27/76 in intervention and control groups, respectively, $p = 0.004$. The distribution of Katz ADL index categories before admission, at discharge and at 12 months are shown in Table IV.

The outpatient rehabilitation consumption after discharge from hospital was similar for the 2 groups, 37 patients in the intervention group and 31 in the control group were given a rehabilitation period after their in-hospital stay with a PT

Table III. *Numbers of participants living independently, independent walking ability, activities of daily living (ADL) performance and odds ratio (OR) of being treated in the intervention group.*

	Intervention $n = 102$	Control $n = 97$	OR*	95% CI
Living independently				
Before fracture	66	60		
On discharge	55	46	0.93	0.32–2.73
At 4-month follow-up	54	46	0.68	0.20–2.27
At 12-month follow-up	47	36	0.91	0.32–2.56
Independent walking ability, at least indoors				
Before fracture	85	85		
On discharge	51	45	0.75	0.34–1.63
At 4-month follow-up	59	52	1.03	0.47–2.24
At 12-month follow-up	55	45	1.13	0.50–2.55
Independent walking without walking aid indoors				
Before fracture	47	55		
On discharge	4	0	†	
At 4-month follow-up	31	19	2.22	0.99–4.95
At 12-month follow-up	35	22	3.01	1.18–7.61
Independent in P-ADL				
Before fracture	47	48		
On discharge	30	20	1.81	0.74–4.37
At 4-month follow-up	35	23	2.51	1.00–6.30
At 12-month follow-up	33	17	3.49	1.31–9.23
Independent in bathing				
Before fracture	46	43		
On discharge	27	16	2.09	0.84–5.18
At 4-month follow-up	33	19	2.84	1.12–7.18
At 12-month follow-up	33	17	3.36	1.25–9.06
Independent in dressing				
Before fracture	64	65		
On discharge	37	25	1.89	0.87–4.11
At 4-month follow-up	43	38	1.15	0.50–2.63
At 12-month follow-up	43	34	1.34	0.57–3.14
Independent in toileting				
Before fracture	77	68		
On discharge	51	49	0.63	0.29–1.14
At 4-month follow-up	59	49	0.95	0.40–2.28
At 12-month follow-up	57	44	1.19	0.50–2.84
Independent in transfer				
Before fracture	88	82		
On discharge	56	52	0.69	0.34–1.40
At 4-month follow-up	61	52	0.86	0.39–1.91
At 12-month follow-up	59	46	1.22	0.54–2.72
Independent in continence				
Before fracture	71	71		
On discharge	57	48	1.30	0.56–3.06
At 4-month follow-up	60	52	1.12	0.45–2.78
At 12-month follow-up	59	41	3.13	1.08–9.04
Independent in feeding				
Before fracture	95	85		
On discharge	81	71	0.70	0.26–1.88
At 4-month follow-up	80	70	0.65	0.20–2.11
At 12-month follow-up	70	61	0.77	0.29–2.05

*Adjusted by a logistic regression analyse for baseline depression and dementia as well as baseline situation of the outcome variable.
†Too few individuals for analysis.
CI: confidence interval, P-ADL: personal/primary activities of daily living.

Table IV. *Distribution of Katz ADL index categories presented as numbers in the intervention and control group, respectively.*

	Intervention	Control	*p*-value*
Katz before admission, $n = 101/94$			
A	50	49	0.789
B	15	13	
C	11	5	
D	1	6	
E	10	9	
F	9	8	
G	3	2	
Not classified	2	2	
Katz at discharge, $n = 96/88$			
A	32	21	0.186
B	12	10	
C	9	14	
D	2	3	
E	3	6	
F	31	19	
G	6	10	
Not classified	1	5	
Katz at 12 month, $n = 84/76$			
A	34	17	0.025
B	14	21	
C	8	3	
D	1	2	
E	5	4	
F	17	17	
G	4	11	
Not classified	1	1	

*Mann-Whitney *U* test.

and/or OT, $p = 0.562$. Of those who were given a rehabilitation period, significantly more participants from the intervention group had received that training at an outpatient centre specializing in rehabilitation for the elderly; 21 compared with 7 in the control group, $p = 0.007$.

The total length of in-hospital stay differed between the groups, the mean inpatient stay in the intervention group was 30.0 days (SD 18.1) compared with 40.0 days (SD 40.6) in the control group, $p = 0.028$. During the first postoperative year, the total mean in-hospital stay, (including both the in-hospital stay in connection with the fracture itself and any in-hospital stays after discharge) was 37.0 days (SD 28.2) in the intervention group and 51.4 days (SD 66.4) in the control group, $p = 0.051$. There were no differences in readmissions, either at 30 days after discharge, 4 vs 5, $p = 0.734$, or during the whole study period, 38 vs 30, $p = 0.484$, for intervention and control group, respectively.

In the intervention group there were fewer participants with postoperative delirium, $p = 0.003$, and fewer numbers of delirious days, $p \leq 0.001$. There were also fewer with urinary tract infections, $p = 0.005$, sleep disturbances, $p = 0.009$, nutritional problems, $p = 0.038$, decubital ulcers, $p = 0.010$, and postoperative falls, $p = 0.007$.

There was no difference in mortality between the groups, at discharge, at 4 months or at the 12-months follow-up. By the 12-months follow-up, 16 patients in the intervention group had died (16%) compared with 18 in the control group (18%), $p = 0.591$.

DISCUSSION

A multidisciplinary postoperative intervention programme using a comprehensive geriatric assessment and management resulted in more participants recovering independence in P- ADL performance at a 4- and 12-month follow-up, controlled for baseline differences, despite shorter hospitalization. More patients in the intervention group had also regained indoor walking ability without walking aids at 12 months.

Among previous randomized controlled trials there is only one study by Reid & Kennie (18), using geriatric rehabilitative care, that showed positive effects from a long-term perspective regarding functional recovery. Their "treatment" group showed a significant effect regarding the Katz ADL index, almost 50% had the same or a better P-ADL performance at 12 months compared with 20% in the control group. In the present study almost 60% in the intervention group attained a better or at least the same level of ADL performance as before the fracture at 12 months. The differences between the groups regarding regaining P-ADL performance according to the Katz ADL index were significant during the whole study period in the present study.

Other intervention studies have failed to achieve functional recovery (10, 11, 14, 15, 17, 19). Some of them showed an improved recovery after 3 months but not at the end of the study (14, 19). It is difficult to compare studies from different countries because of the differences in healthcare organization and rehabilitation routines and, in addition, the differing aims, interventions, observation times and outcomes measures make comparisons even more difficult.

Despite a shorter in-hospital stay after surgery, there were no further readmission days during the first postoperative year, which supports the claim that the intervention programme had a positive effect. The number of outpatient rehabilitation periods after hospital discharge were similar in the 2 groups, but a larger proportion of the participants from the intervention group were given rehabilitation at a centre that specialized in rehabilitating the elderly. That, in combination with the postoperative 4-month follow-up by a geriatric team, focusing on the detection and prevention of complications as well as on initiating further rehabilitation if needed, might have influenced the increased differences in ADL performance and mobility at the 12-month follow-up.

One limitation of the present study is that the outpatient rehabilitation after discharge was not as standardized as during the in-hospital stay. In the intervention programme the aim was to have a well-planned discharge followed up with a telephone call and a home visit. The patients were also offered further rehabilitation after discharge, but the intensity and quality of that outpatient rehabilitation is unknown. We have data only on the number of occasions.

Another limitation is that the assessors where not blinded concerning group allocation during the home visit and therefore bias cannot be excluded. On the other hand, the nurse who performed assessments in the intervention group was from the orthopaedic unit and the nurse who did the same assessments in the control group was from the geriatric unit. This should have reduced assessor bias. Another disadvantage is that we do not have any figures for cost effectiveness, but the fact that the intervention group had 14 fewer in-hospital days during the 12-months follow-up suggests that the intervention programme was less expensive than the conventional care used for the control group, despite the intervention group having one extra visit from a geriatrician at 4 months. The in-hospital stay was shorter for the intervention group, but the staff rates on the wards were similar in both groups, and both in-hospital days and outpatient treatment were also similar after discharge from hospital.

One strength in the present study is that the 2 groups had a small and similar dropout rate over time, only 2 people in each group refused the follow-up visits and 1 in the control group had moved to another part of the country.

The results from the present study, the Cochrane review and the meta-analysis (8, 9) support the view that a comprehensive geriatric assessment, management and rehabilitation approach is important for this group of patients and might be advantageous both for elderly hip-fracture patients and for the healthcare system.

We found benefits in functional recovery in conjunction with the intervention programme, but there are still many who never regain the function they had before the fracture occurred. Future research should include an even more comprehensive and intensive intervention to optimize the situation for those who suffer a hip fracture; the outpatient rehabilitation especially should be more individualized and at higher intensity. It has been reported that extended outpatient rehabilitation, including progressive resistance training, is effective in improving physical function among elderly community-dwelling hip-fracture patients (28). Exercise at home has also been reported to be effective among this group of patients (29).

In conclusion, a multidisciplinary postoperative intervention programme resulted in a larger proportion of participants regaining independence in P-ADL performance as well as a larger proportion walking indoors without walking aids 1 year after a femoral neck fracture.

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