Clinical Rehabilitation 2002; **16**: 406–413

Early discharge and home rehabilitation after hip fracture achieves functional improvements: a randomized controlled trial

Maria Crotty, Craig H Whitehead, Steven Gray and **Paul M Finucane** Department of Rehabilitation and Aged Care, Repatriation General Hospital, Daw Park, Australia

Received 7th August 2001; returned for revisions 26th October 2001; revised manuscript accepted 5th December 2001.

Objective: To compare hospital and home settings for the rehabilitation of patients following hip fracture.
Design: Randomized controlled trial comparing accelerated discharge and home-based rehabilitation ($n = 34$) with conventional hospital care ($n = 32$) for patients admitted to hospital with hip fracture.
Setting: Three metropolitan hospitals in Adelaide, Australia.
Subjects: Sixty-six patients with fractured hip.
Interventions: Patients assigned to the home-based rehabilitation group were discharged within 48 hours of randomization. The project team therapists made visits to the patient's home and negotiated a set of realistic, short-term and measurable treatment goals with both the patient and carer. Those randomized to usual care remained in hospital for conventional rehabilitation.
Main outcome measures: Physical and social dependence, balance confidence, quality of life, carer strain, patient and carer satisfaction, use of community services and incidence of adverse events such as re-admission and falls.
Results: While there was no difference between the groups for all measures of quality of life, patients in the accelerated discharge and home-based rehabilitation group recorded a greater improvement in MBI from randomization ($p < 0.05$) and scored higher on the Falls Efficacy Scale ($p < 0.05$) at four months. There was no difference in falls rates. Patients in the home-based rehabilitation group had a shorter stay in hospital ($p < 0.05$) but a longer stay in rehabilitation overall ($p < 0.001$). The groups were comparable on the rate and length of admissions after discharge, use of community services, need for carer input and contact with general practitioner (GP) after discharge.

Address for correspondence: Maria Crotty, Department of Rehabilitation and Aged Care, Repatriation General Hospital, Daws Road, Daw Park 5041, Australia. e-mail: maria.crotty@flinders.edu.au

10.1191/0269215502cr518oa

Conclusions: This trial further supports the practice of accelerated discharge from hospital and home-based rehabilitation in selected patients recovering from hip fracture. Such a practice appears to improve physical independence and confidence in avoiding subsequent falls which may have implications for longevity and overall quality of life.

Introduction

Many health regions are setting up accelerated discharge and home rehabilitation teams for conditions such as hip fracture. The programmes offered by these teams have been proposed as safe, cost effective, efficient alternatives to conventional hospital care although high-quality evidence for such programmes is still limited.[1] Discharge and rehabilitation in the home has the potential to increase access to rationed specialist services such as rehabilitation by increasing throughput. Short hospital stays with home based programmes provide patients with increased choices about care[2] and reduce the risk of iatrogenic events.[3] Furthermore, by bridging the hospital–community interface they also potentially allow the establishment of evidence-based falls-prevention strategies in this high-risk population by incorporating a thorough environmental assessment and the establishment of a supervised home exercise programme.[4]

While several studies have suggested that similar outcomes can be achieved with accelerated discharge[5–8] the few randomized controlled trials of home-based rehabilitation in patients following orthopaedic surgery have not included outcomes such as balance, strength and falls. Shepperd *et al.*[9] found improved quality of life among those undertaking home-based rehabilitation, and Cameron *et al.*[6] reported improved physical independence among a subset of similar patients with limited disability. While only one of these studies[9] reported on adverse events such as re-admissions to hospital or falls, neither addressed outcomes of relevance to falls prevention. Despite favourable results to date it is likely that the success of home-based rehabilitation programmes varies substantially with factors specific to the local hospital and community. Our hospital received funding to set up an accelerated discharge and home rehabilitation team for older patients who had recently suffered a stroke, a lower limb fracture or a joint replacement operation. We decided to evaluate the effect of the programme on the hip fracture patients referred as we knew they were likely to be frail older women living alone who might not benefit from early discharge. For the first 12 months of the programme patients with hip fracture only received home rehabilitation if they were part of the trial. We compared the effectiveness of accelerated discharge and home-based rehabilitation with conventional hospital care for patients recovering from hip fracture and examined differences between patient and carer outcomes at four months for these groups. A comparison of the cost of care for home-based rehabilitation versus conventional care for patients was conducted in parallel and will be reported separately (unpublished results).

Methods

Participants

Patients were eligible for inclusion in the study if they were admitted for treatment of a fall-related hip fracture to one of three hospitals which serve southern Adelaide, two teaching hospitals (Flinders Medical Centre, Repatriation General Hospital) and a private hospital with an emergency service (Ashford Community Hospital). Patients were eligible if they were: treated surgically, aged 65 years and over, medically stable, had adequate physical and mental capacity to participate in a rehabilitation programme, expected to return home after discharge from hospital and had a home environment suitable for rehabilitation. Patients were excluded if they had inadequate social support in the community, no telephone at home or did not live in Adelaide's Southern Metropolitan Region. Patients also needed to agree to hospital re-admission should complications occur.

The study protocol was approved by the ethics

committees of the three hospitals from which participants were recruited. Written informed consent was obtained from all participants prior to randomization.

Randomization

After completing a baseline assessment participants were randomized to either accelerated discharge and home-based rehabilitation or conventional care. Randomization was computer-generated and was performed by a hospital pharmacist who was unaware of the medical status of the patient and who had no other involvement in this study.

Accelerated discharge and home-based rehabilitation

Participants randomized to receive accelerated discharge and home-based rehabilitation were initially assessed by the study co-ordinator who visited their home environment and organized any modifications, installation of equipment or assistive aids prior to discharge. General practitioners (GPs) were contacted and asked to consent to their patient entering the programme. Participants were discharged from acute care within 48 hours of randomization and promptly visited by therapists from the home rehabilitation team including a team co-ordinator, a physiotherapist, an occupational therapist, a speech pathologist, a social worker and a therapy aid, who negotiated realistic, short-term and measurable treatment goals with both the participant and their carer. The goals included outcomes relevant to participants' day-to-day lives, such as the ability to do the shopping or cook a meal. Therapy frequency was tailored to the needs and rate of progress of individual participants, and structured practice sessions were encouraged between visits. Progress was reviewed at weekly case conferences attended by all staff and a specialist in rehabilitation medicine or a geriatrician. Staff also communicated about the condition of participants through notes in files maintained at participants' homes. Standard therapy services such as podiatry, nursing care and assistance with light domestic tasks (shopping/cleaning) were provided as required. The decision to discharge participants from the rehabilitation programme was made in consultation with the rehabilitation consultant and, when necessary, participants were referred to community agencies for ongoing care.

Conventional care

Those allocated to conventional care received routine hospital care and rehabilitation in hospital. This consisted of inpatient services and involved the development of care pathways and discharge planning.

Study assessments and outcomes

Data collected at baseline included: demographic information (age, gender, marital status, accommodation, non-English speaking background, living alone); measures of the level of independence before the fracture (pre-fracture Modified Barthel's Index (MBI),[10] use of mobility aids, use of community services); and details of the fracture and treatment whilst admitted to acute care. Patients were also administered standard questionnaires including measures of current ability to perform day-to-day activities (the MBI), cognitive function (the Mini-Mental State Examination)[11] and health-related quality of life (the SF-36).[12]

Follow-up data were collected four months after randomization during face-to-face interviews. The outcome assessor was blind to allocation, however the patients were not. At the end of the trial we asked the outcome assessor to guess the allocation of patients.

The four-month outcome assessment included measures of mobility (Timed Up & Go)[13] and four measures of physical function: the Activities-specific Balance Confidence Scale,[14] the Falls Efficacy Scale,[15] the Berg Balance Scale[16] and the London Handicap Scale.[17] Information on adverse events such as falls and hospital re-admissions was recorded. Hospital records were audited at four months to check the data on re-admissions. Patients and carers were also asked to answer five questions about their level of satisfaction with various aspects of the programme with responses recorded on a five-point Likert scale ranging from very dissatisfied to very satisfied, the SF-36 quality of life questionnaire[12] and were asked a series of questions about their use of community services since discharge (e.g. district nursing, home help). Carers also completed the SF-36 and Caregiver Strain Index.[18]

Statistical considerations

A sample size of 66 patients (33 in each treatment arm) was required (power = 80%) to detect a difference of seven points on the physical and mental health summary scores assuming a standard deviation of 10. A seven-point difference on the SF-36 physical health component is indicative of limitations in use of an arm or leg.

Patients were analysed on an 'intention to treat' basis. All analyses were conducted using the SPSS statistical package version 9.0 (Norusis MJ. SPSS for Windows: Advanced Statistics, USA). Differences between groups on continuous variables that were not normally distributed according to the Shapiro–Wilk test were analysed with the Mann–Whitney *U*-test, otherwise independent sample *t* tests were used. Fisher's test of exact probability was used to compare proportions. All comparisons were two-tailed.

Results

Between July 1998 and July 1999, 66 out of 188 (35%) hip fracture patients were enrolled in the study: thirty-four were randomized to receive accelerated discharge and home-based rehabilitation and 32 to conventional hospital care. Further data on recruitment rates for the two study groups can be found elsewhere.[19]

There was no difference between groups in age, pre-morbid use of mobility aids, MBI, Mini-Mental Status Examination score or percentage living alone (Table 1).

There was little difference in the length of time these patients spent in the acute orthopaedic ward (nine days in conventional care group versus eight days in home rehabilitation group) (Table 1). Patients in the accelerated discharge and home-based rehabilitation group had a shorter stay in hospital ($p < 0.05$) but a longer stay in rehabilitation overall (hospital plus home, $p < 0.001$) (Table 2). The rate and length of admissions after discharge (related, unrelated and total) did not differ significantly between groups. The groups were comparable on use of community services, carer time and GP contact after discharge.

Table 3 shows the outcomes of the two groups. Home rehabilitation patients recorded a greater improvement in MBI from baseline ($p < 0.05$), and scored higher on the Falls Efficacy Scale ($p < 0.05$) at four months (Table 3). At four-month follow-up, no differences between groups were found for patients or carers on the SF-36 Physical Component Scale (PCS) or Mental Component Summary Scale (MCS) scales or the amount of change in PCS scores between baseline and four month follow-up for patients and carers. Comparison of the change in MCS scores over the same period showed that scores for carers of patients in the Home Care group had improved relative to carers of hospital rehabilitation patients ($p < 0.05$) (Table 3).

The blinded outcome assessor correctly guessed the allocation of 31 of the 66 participants (47%) which was 18 of the 34 intervention patients and 13 of the 32 control patients.

Discussion

In this trial of early discharge and home rehabilitation we found that at four months the intervention group had greater physical independence as assessed by the MBI and more confidence that they would avoid falling whilst undertaking activities of daily living than the group receiving conventional hospital rehabilitation. Earlier trials have suggested that home programmes achieve similar outcomes for patients and carers.[7,20] Our results suggest there may be advantages for

Clinical messages

In this trial of accelerated discharge and home-based rehabilitation for older adults recovering from hip fracture:

- While patients allocated to receive accelerated discharge and home-based rehabilitation did not report an improvement in their physical health, they did report a greater improvement in their ability to conduct activities of daily living.
- Patients allocated to receive accelerated discharge and home-based rehabilitation had greater confidence in avoiding subsequent falls at four months follow-up.

patients in rehabilitation at home. The results are consistent with work suggesting that following hip replacement quality of life is improved if rehabilitation occurs at home[21] and that home-based rehabilitation for up to six months is feasible, acceptable and effective.[22]

By conducting supervised rehabilitation in the environment in which the original injury occurred, home-based rehabilitation may enhance patients' confidence in their ability to function in this environment. In this small trial the home-based rehabilitation group showed more improvement in physical independence from baseline and there was a difference between the groups for physical independence at four months follow-up. However we were unable to detect a difference between the groups for the main outcome measure; the physical component scale of the quality of life measure (SF-36) or in the number of falls that occurred. Low patient numbers in this study means that there was insufficient power to detect differences in many outcome measures; in particular we had limited power to assess the impact on carers. Both patients and carers in the accelerated discharge and home-based rehabilitation group recorded scores of 20/25 on a satisfaction questionnaire, indicating that on average they were 'quite satisfied' with the programme. However the consent process allowed patients with a pre-existing preference for hospital care to refuse the possibility of home rehabilitation and automatically transfer to hospital rehabilitation.[9]

Difficulties with the recruitment for this study

Table 1 Patient characteristics at baseline

	Conventional care (*N* = 32)	Home care (*N* = 34)
Demographic		
Gender: female *N* (%)	24 (75%)	21 (62%)
Age: Median (quartiles)	83.5 (76.6, 85.5)	81.6 (78.2, 85.4)
Have carer: *N* (%)	18 (56%)	21 (62%)
Age of carer: mean (95% CI)	68.9 (61.0, 76.8)	69.4 (62.2, 76.6)
Marital status: married/de facto: *N* (%)	16 (50%)	9 (27%)
Lived alone before fracture: *N* (%)	11 (34%)	15 (44%)
Non-English speaking background: *N* (%)	6 (19%)	5 (15%)
Independence before fracture		
Pre-fracture MBI: median (quartiles)	100.0 (92.0, 100.0)	100.0 (94.5, 100.0)
Mobility aids used: *N* (%)	17 (53%)	17 (50%)
Community services used: *N* (%)	11 (34%)	9 (27%)
Details of fracture & acute treatment		
Surgical procedure: *N* (%)		
Austin–Moore prosthesis	11 (34%)	9 (26%)
Bipolar prosthesis	3 (9%)	3 (9%)
Internal fixation	17 (53%)	22 (65%)
Total hip replacement	1 (3%)	0 (0%)
Complications: *N* (%)		
Pneumonia	2 (6%)	2 (6%)
Wound infection	0 (0%)	2 (6%)
Pressure sores	1 (3%)	1 (3%)
Confusion	7 (22%)	7 (21%)
Urinary tract infection	1 (3%)	1 (3%)
Other	21 (65%)	17 (52%)
Any	21 (66%)	18 (55%)
Days to mobilize after surgery: median (quartiles)	1.0 (1.0, 2.0)	1.0 (1.0, 2.0)
Length (days) of acute care: median (quartiles)	9.0 (5.3, 12.0)	8.0 (6.0, 12.5)
Health status at baseline		
MBI at randomization: median (quartiles)	85.0 (77.0, 89.0)	85.0 (79.0, 89.0)
Mini-Mental State Examination score: median (quartiles)	28.0. (27.0, 29.0)	26.0 (24.0, 29.0)

Table 2 Use of resources. Values are means with 95% confidence intervals

	Conventional care ($N = 32$)	Home care ($N = 34$)
Randomization to discharge from programme		
Length of stay (days)		
Hospital rehabilitation	14.3 (10.5, 18.1)	7.8 (4.5, 11.0)**
Home rehabilitation	N/A	20.3 (16.6, 24.0)
Total rehabilitation	14.3 (10.5, 18.1)	28.3 (23.1, 33.6)
Home visits by therapists	N/A	13.6 (12.0, 15.3)
Discharge from programme to four-month follow-up		
Re-admissions to hospital[a]		
Related admissions	0.27 (0.07, 0.46)	0.22 (0.01, 0.45)
Length of related admissions (days)	3.6 (0.5, 6.7)	3.7 (0, 7.8)
Unrelated admissions	0.43 (0.11, 0.75)	0.81 (0.23, 1.40)
Length of unrelated admissions (days)	4.9 (0.4, 9.4)	4.6 (0.9, 8.3)
Carer time (proportion time spent)	22.1% (9.6, 34.7)	18.6% (6.3, 30.9)
Visits to GPs	4.5 (3.3, 5.8)	3.3 (2.4, 4.3)
Use of community services: N (%)[b]	23 (77%)	19 (63%)

[a]Includes all re-admissions, including those later than four months after discharge.
[b]Number (%) using any of: outpatient rehabilitation, private therapy, district nursing, day care, respite care, employment rehabilitation training, carer time off work and Meals on Wheels.
**Statistically significant difference ($p < 0.05$) between groups.

are reported elsewhere.[19] At Flinders Medical Centre only 20% of the hip fracture population were both eligible for home rehabilitation and agreed to enter the trial. Home rehabilitation was a new programme and patients refused due to a preference for inpatient rehabilitation, reluctance on the part of their family, and anxiety about their ability to manage at home. It appears that home rehabilitation is still unacceptable to a large proportion of patients who fracture their hip and their families. Furthermore, the wider use of home rehabilitation will be affected by the possible additional demands placed on the patient's general practitioner. In our project we asked the GPs for consent prior to discharging the patient home and none refused. The programme did, however, result in extra work for many of them as although there were hospital specialists on call patients tended to call the GPs if problems arose and this invariably meant a visit to the home for the GP.

In summary, despite its limited sample size, our randomized study has provided some evidence to support accelerated discharge and home-based rehabilitation for older adults recovering from a fall-related fractured hip. It appears that for the least disabled group of fallers home-based rehabilitation will result in improvements in independence and confidence to perform day-to-day activities without falling.

Acknowledgements

This project was funded by a grant from the South Australian Department of Human Services. Thanks to Nikki Hayball and Sara Laubscher for help with data collection.

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Table 3 Outcomes at four-month follow-up. Values are medians (25th and 75th percentiles) unless stated otherwise

	Conventional care (*N* = 32)	Home care (*N* = 34)
Outcomes for patients		
Modified Barthel's Index	94.0 (83.7, 97.0)	97.0 (93.5, 99.0)**
Modified Barthel's Index (change from baseline)	8.0 (–2.5, 13.5)	11.0 (5.5, 16.0)**
Falls: *N* (%)		
None	27 (84%)	27 (79%)
1 or more	4 (13%)	6 (18%)
missing data	1 (3%)	1 (3%)
Falls requiring hospitalization: *N* (%)		
None	31 (97%)	33 (97%)
1	1 (3%)	1 (3%)
missing data	1 (3%)	1 (3%)
Activities-specific Balance Confidence Scale	53.3 (26.8, 74.6)	61.3 (45.5, 75.2)
Berg Balance Scale	37.5 (26.3, 45.3)	43.5 (34.3, 52.5)
Falls Efficacy Scale	79.5 (40.0, 92.5)	90.5 (80.5, 98.0)**
London Handicap Scale: Mean (95% CI)	0.65 (0.58, 0.73)	0.70 (0.63, 0.77)
Timed Up-and-Go	28.0 (18.0, 42.5)	23.0 (15.3, 33.0)
SF-36 PCS score: Mean (95% CI)	26.9 (10.2, 42.0)	38.3 (27.9, 48.7)
SF-36 PCS score (change from baseline)	–3.9 (–19.5, 11.7)	–3.4 (–14.9, 8.1)
SF-36 MCS score: Mean (95% CI)	42.8 (31.2, 54.4)	46.4 (36.2, 56.6)
SF-36 MCS score (change from baseline)	–11.7 (–23.4, 0.05)	0.01 (–13.8, 13.8)
Satisfaction total score	20.0 (18.0, 22.0)	21.0 (19.0, 23.0)
Outcomes for carers		
SF-36 PCS score: Mean (95% CI)	35.5 (22.1, 48.9)	46.6 (38.7, 54.5)
SF-36 PCS score (change from baseline)	–5.2 (–16.4, 6.0)	–0.9. (–7.1, 5.3)
SF-36 MCS score: Mean (95% CI)	47.1 (35.1, 59.1)	54.8 (53.3, 56.4)**
SF-36 MCS score (change from baseline)	–4.7 (–19.8, 10.3)	3.7 (–2.5, 9.9)
Satisfaction total score: Mean (95% CI)	19.4 (17.0, 21.9)	20.4 (18.5, 22.3)
Caregiver Strain Index	2.0 (0, 6.8)	1.0 (0, 4.0)

**Statistically significant difference ($p < 0.05$) between groups.
Higher scores for Activities-specific Balance Confidence Scale, Berg Balance Scale, Falls Efficacy Scale, all SF-36 measures and the Satisfaction total score indicate a better score or a greater improvement.
Lower scores for London Handicap Scale, Timed Up-and-Go and the Caregiver Strain Index indicate a better score or a greater improvement.

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