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Original Study

Effects of a Multicomponent Home-Based Physical Rehabilitation Program on Mobility Recovery After Hip Fracture: A Randomized Controlled Trial

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A B S T R A C T

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Objective: To investigate whether a home-based rehabilitation program for community-dwelling older people with recent hip fracture is more effective than standard care in improving mobility recovery and reducing disability.

Design: Randomized, controlled, parallel-group trial.

Setting: Rehabilitation in participants' homes; measurements in university-based laboratory and local hospital.
Participants: Clinical population of community-dwelling men and women (aged 60+) recovering from hip fracture. Participants were randomly assigned into control ($n = 41$) or intervention ($n = 40$) groups on average 42 ± 23 days after discharge home.

Intervention: A yearlong multicomponent home-based rehabilitation aimed at promoting mobility recovery and physical functional capacity after hip fracture. The intervention included evaluation and modification of environmental hazards, guidance for safe walking, nonpharmacological pain management, a progressive home exercise program, physical activity counseling, and standard care.

Measurements: Measurements were outlined according to the tiers of the disablement process, with the ability to negotiate stairs as the main outcome. Prefracture ability to negotiate stairs was enquired at the hospital on average 10 ± 5 days after fracture. Subsequently, current perceived ability to negotiate stairs was reported immediately before the intervention (on average 9 weeks after surgery) and 3, 6, and 12 months thereafter. Other measurements included leg extension power deficit (LEP), functional balance (Berg Balance Scale) and lower extremity performance (Short Physical Performance Battery). Effects of the intervention were analyzed with generalized estimation equations and longitudinal repeated measures mixture path models.

Results: The intervention reduced perceived difficulties in negotiating stairs (interaction, group \times time $P = .001$) from prefracture to 12 months compared with the control condition. The mixture path model revealed that less difficulty in negotiating stairs at 6 and 12 months correlated with better functional balance at 3 and 6 months in the intervention group but not controls (group difference $P = .007$ and $P < .001$, respectively).

Conclusion: The individualized home-based rehabilitation program improved mobility recovery after hip fracture over standard care. To be efficacious in reducing or reversing disability after hip fracture, rehabilitation needs to be individualized, include many components, be progressive, and span a sufficiently long period. Current Controlled Trials (ISRCTN53680197).

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The authors declare no conflicts of interest.

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Mobility recovery after hip fracture is challenging. Major trauma, related surgery, and hospitalization lead to a dramatic decline in muscle power on the side of the fracture and consequent asymmetrical muscle power deficit.¹ Poor muscle power and asymmetrical deficit are associated with poor standing balance, slower walking

speed, and increased risk for injurious falls,^{2,3} thereby increasing the risk for unsuccessful mobility recovery and further mobility disability.

Different physical functions do not recover simultaneously after hip fracture.^{4,5} For most routine mobility functions, like walking independently, with or without walking aids, the recovery occurs for the most part within the first few months after discharge from hospital.⁵ The more challenging mobility functions, which require more strength and balance than walking, such as negotiating stairs, require a longer recovery period of up to 1 year post discharge.⁵ The presence or absence of perceived difficulties in negotiating stairs describes a person's mobility ability in everyday life.^{5–8}

Previous experimental studies investigating the effects of rehabilitation on mobility recovery after a hip fracture have focused on single outcome measures only, rather than looking at the whole recovery process, from the physiological to functional prerequisites for walking and, finally, to the ability or difficulty in walking in one's environment. To achieve an optimal rehabilitation outcome, it would be logical to acknowledge the complexity of reenablement and to target and follow up all the functional tiers in the disablement process⁹ during the recovery phase. To our knowledge, no previous studies have investigated the effects of rehabilitation on mobility recovery in the context of functional tiers, as outlined in the disablement process,^{9,10} following hip fracture.

Currently, as acknowledged by recent Cochrane Reviews^{11,12} and National Institute for Health and Clinical Excellence guidance¹³ studies, there are no generally accepted rehabilitation guidelines for mobility and functional capacity recovery after hip fracture. Most of the studies on this topic have used efficacy-driven research designs with relatively short interventions organized in outpatient clinics with homogeneous groups of hip fracture participants. In many such studies, the persons likely to benefit the most from a program including physical exercise have been excluded. Traveling to organized sessions on a weekly basis may be too demanding for many older people who are frail and suffer from pain and fear of falling after a fracture. Therefore, a home-based individually tailored rehabilitation program may be the most promising strategy for mobility recovery and prevention of mobility disability after hip fracture.

Only a few home-based rehabilitation studies among community-dwelling older people recovering from hip fracture have been published.^{14–17} In those studies, self-reported or performance-based mobility has been assessed as a secondary outcome only, and the results obtained have been contradictory. However, among community-dwelling frail older people, home-based multicomponent rehabilitation reduced the progression of functional decline.¹⁸ In this study by Gill et al. (2002), rehabilitation included instructions for safe moving and use of assistive devices, removing environmental hazards, and a progressive exercise program. These encouraging results suggest that a similar approach might also be efficacious among hip fracture patients.

The aim of this randomized controlled trial was to investigate the effects of an individually tailored multicomponent home-based rehabilitation program on mobility recovery compared with standard care in community-dwelling men and women older than 60. The study began soon after discharge home from the hospital.

Methods

Study Design and Participants

A detailed description of the design of this randomized controlled trial and participant recruitment (ISRCTN53680197) has been published earlier.¹⁹ Briefly, staff of the physiotherapy department at the local hospital reviewed the medical records of all the ambulatory and community-dwelling men and women aged 60 and older arriving for

surgery for a femoral neck or pertrochanteric fracture (ICD code S72.0 or S72.1) who were residents in the city of Jyväskylä or 1 of the 9 neighboring municipalities. All patients fulfilling the inclusion criteria were informed about the study ($n = 296$). Of those, 161 expressed interest in participation and were further visited by a researcher. Finally, 136 persons were recruited to the study. Patients suffering from severe memory problems (Mini Mental State Examination [MMSE] < 18), alcoholism, a severe cardiovascular or pulmonary condition or some other progressive disease, or suffering from severe depression (Beck Depression Inventory [BDI-II] > 29) were excluded from the study. After exclusions, 81 patients with hip fracture participated in the study. The study flow chart is shown in Figure 1.

The pretrial power calculations were based on previously published longitudinal data on mobility recovery after a hip fracture.⁶ In that study, 45.3% of the community-dwelling participants on average were independent in 3 mobility tasks (chair rising, walking 1 block, and negotiating stairs) before the fracture. One year after hip fracture, 20.7% of the sample on average had regained their prefracture level of mobility. Based on those numbers, a minimum of 44 participants were needed in each group (in total 88 participants) to detect the expected difference between the study groups at a level of significance of $\alpha = 0.05$ and $\beta = 0.20$. All participants gave their written informed consent before participating in the study and gave permission to review their medical records. The ethical committee of the Central Finland Health Care District approved the study protocol. This trial was registered with Current Controlled Trials Ltd. (ISRCTN53680197).

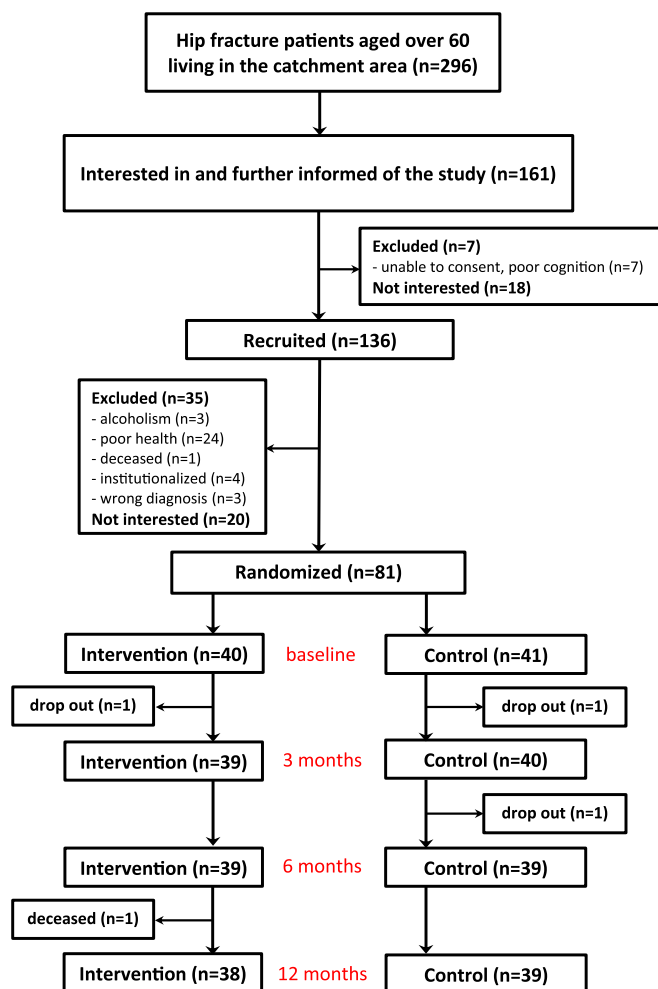


Fig. 1. Flow chart of the study.

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