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Balance confidence and functional balance are associated with physical disability after hip fracture

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ABSTRACT

Background: This cross-sectional study investigated the associations between balance confidence, functional balance, and physical disability among older people after hip fracture.
Material and methods: The study utilizes baseline data of two randomized controlled trials (ISRCTN34271567 and ISRCTN53680197). The participants were 159 community-dwelling over 60-year-old people. Health, fracture status, the date and type of surgery, and contraindications for participation were assessed in a clinical examination. Balance confidence was assessed by the Activities-specific Balance Confidence Scale (ABC) and functional balance by the Berg Balance Scale. Physical disability was assessed by a questionnaire containing 14 questions on perceived difficulty in basic (ADL) and instrumental activities of daily living (IADL). Two sum scores were composed: ADL score (range 0–6) and IADL score (range 0–8). Isometric knee extension force was measured using a dynamometer. Pain and use of walking aids were assessed by a questionnaire. The negative binomial regression analysis was used to analyze the associations.
Results: A higher ABC score was associated with a lower risk for ADL (IRR 0.99; 95% CI 0.98–0.99) and IADL disability (0.99; 0.98–0.99) in the fully adjusted models. Also a higher BBS score was associated with a lower risk for ADL (0.98; 0.96–0.99) and IADL disability (0.98; 0.97–0.99) in the fully adjusted models.
Conclusion: Decreased balance confidence and impaired functional balance are associated with physical disability in older people after hip fracture.

1. Introduction

Hip fracture is a common and severe trauma in older people, leading to balance impairments, decreased muscle strength, and loss of independence in daily activities [1,2]. It is also known that only half of the hip fracture patients regains their pre-fracture level of functional ability [2] and 15% will be institutionalized permanently [3]. Long-lasting mobility limitation after hip fracture may lead to prolonged physical disability as well as new injurious falls and fractures [2]. The incidence of hip fractures increases with age and the total number of fractures is expected to rise due to aging of the population [4].

Although only 5% of all falls cause a fracture, approximately 95% of all hip fractures are caused by a fall [5,6]. The risk factors for falls interact with each other and large individual variation exists. The risk of falling increases rapidly with the number of risk factors. Impaired functional balance is considered the most common risk factor for further falls and fractures after a previous hip fracture [7]. Balance control has also a fundamental role in various activities of daily living, especially in those that require independent standing or walking. Furthermore, those who have had a fall with a traumatic consequence often experience fear of falling even years after the incident [7]. Additionally, fear of falling has been strongly associated with future falls [8,9].

One method of operationalizing fear of falling is to assess self-reported balance confidence using the Activities-specific Balance Confidence Scale (ABC) described by Powell and Myers

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[10]. Decreased balance confidence has been associated with poor functional balance, increased disability, and reduced quality of life in community-dwelling older people [8,11,12]. Individuals with low balance confidence and balance impairments are also likely to reduce their physical and social activity, which in turn predicts the onset of disability [13]. Based on our clinical experience, self efficacy and balance confidence are low in hip fracture patients who have suffered a traumatic fall accident, which might drastically slow down or disable the rehabilitation process. At the moment the scientific evidence regarding the association between balance confidence and rehabilitation outcome after hip fracture is insufficient.

To the best of our knowledge there are no other studies that have simultaneously examined associations of low balance confidence and balance impairments in relation to physical disability, in older people who have suffered a hip fracture. However, these associations should be studied to better understand the factors potentially affecting the recovery and rehabilitation processes after hip fracture. The purpose of this study was to investigate the associations between decreased balance confidence, impaired functional balance, and physical disability among older people who have sustained a previous hip fracture.

2. Material and methods

2.1. Participants

This cross-sectional study pooled the baseline data of two randomized controlled trials (ISRCTN34271567 and ISRCTN53680197). In both studies the participants were recruited from the Central Finland health care district with identical inclusion and exclusion criteria [14,15]. Patient records at the Central Finland central hospital were reviewed (in the fall of the years 2004–2005 and throughout the years 2008–2010) to recruit over 60-years-old, ambulatory and community-dwelling people who were living in the city of Jyväskylä or the neighboring municipalities, and had been operated for femoral neck or trochanteric fracture (ICD code S72.0 or S72.1). All potential participants ($n = 748$) were informed of the study by a written information letter. Those willing to participate ($n = 293$) were interviewed over the telephone or met during the inpatient period at the health care center to ensure their suitability for the study. The exclusion criteria were: inability to move outdoors without assistance of another person, amputation of a lower limb, severe progressive or neurological diseases, alcoholism and severe memory problems (Mini Mental State Examination, MMSE < 18 [16]). The pooled analysis includes information collected from 159 participants (113 women, 46 men) who had sustained a hip fracture on average 1.7 years earlier. Measurements were performed in the same research center using the same equipment and protocols. The Ethical Committee of the Central Finland health care district approved both studies. Before the laboratory assessments all participants gave their written informed consent.

2.2. Methods

2.2.1. Review of the medical data and health status

During a medical examination performed by a nurse and physician, the presence of chronic conditions, the use of prescription medication, fracture status, and the date and type of surgery were confirmed according to a pre-structured questionnaire, current prescriptions, and medical records obtained from the local hospital and health care centers. Contraindications for participation in muscle strength and balance assessments were evaluated by the physician [17].

2.2.2. Balance confidence

A modified Finnish version of the Activities-specific Balance Confidence Scale (ABC [10,18]) was used to assess confidence in performing specific activities without becoming unsteady. Balance confidence can be regarded as a measure of fear of falling [10]. The modified ABC scale consists of 16 items. Subjects are requested to describe, how confident they are in carrying out different tasks, indoors and outdoors. Answers for each question were rated from 1 (no confidence) to 10 points (total confidence). The total score ranges from 16 to 160 and higher scores indicate better balance confidence.

2.2.3. Functional balance

Functional balance was assessed by the Berg Balance Scale (BBS [19]) which evaluates the ability to perform 14 different tasks such as standing up, sitting down, reaching and turning around oneself, looking over the shoulders and standing on one foot. The ability to perform each task is rated from 0 (incapable) to 4 (safe and independent). The total score ranges between 0 and 56 and higher scores indicate better functional balance.

2.2.4. Physical disability

Physical disability was assessed by a validated questionnaire [20] estimating perceived difficulties in basic (ADL) and instrumental activities of daily living (IADL). The questionnaire included six questions on ADL (eating, transferring from/to bed, dressing, bathing, cutting toe nails, and toileting [20,21]) and eight questions on IADL (preparing food, doing laundry, coping with light house work, coping with heavy house work, handling medication, using the telephone, using public transportation, and handling finances [20,22]). There were five response categories: (1) I manage without difficulties; (2) with some difficulties; (3) with lots of difficulties; (4) I can not manage without assistance of another person and (5) I can not manage even when assisted. The original categorical variables were dichotomized: (a) without difficulty (category 1) and (b) difficulty (categories 2–5). Subsequently, two sum scores were composed: ADL score (ranging from 0 to 6) and IADL score (ranging from 0 to 8). Higher scores indicate more difficulty.

2.2.5. Confounders

Isometric muscle force (N) for knee extension was measured on the fractured side by an adjustable dynamometer chair (Metitur Ltd. [23]). During the measurement the ankle was attached to a strain-gauge system with the knee angle fixed at 60° from full extension. Participants were encouraged to extend the leg as hard as possible. After two to three practice trials, measurements were performed at least three times until no further improvement occurred. Each contraction was maintained for two to three seconds. The inter-trial rest period was 30 s. The performance of the highest maximal force was used for analysis.

Pain on the fractured side was assessed by two questions: "Have you experienced pain in the lower back, hip, knee, ankle or foot on your left/right side? Has the pain compromised your mobility?" The response alternatives were: (1) no; (2) yes, but it is not offending; (3) yes, and it is offending. A new variable "offending pain of the fractured side" was composed based on the answers. The use of walking aids outdoors was assessed by the question: "Do you use walking aids when going outdoors?" Response alternatives were yes/no.

2.2.6. Statistical analysis

The means, standard deviations, frequencies, and percentage values were calculated for the background variables. The associations between balance confidence and physical disability as well as between functional balance and physical disability were assessed by negative binomial regression which is a generalization of the