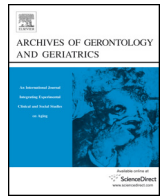




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Factors influencing the progress of mobilization in hip fracture patients during the early postsurgical period?—A prospective observational study

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ABSTRACT

Objective: The aim of the present study was to determine the independent factors influencing mobilization progress after geriatric hip fractures.

Patients and Methods: 392 Hip fracture patients older than 60 years were included in this prospective, observational, cohort study. The progress of mobilization was measured with walking ability 4 days post-surgery, ability to climb stairs until discharge and the Tinetti test at discharge. Factors correlated with the progress of mobilization were determined using multivariate analyses.

Results: The independent factors influencing walking ability 4 days post-surgery were the pre-fracture Charlson Comorbidity Index (OR = 0.834, $p = 0.005$), the American Society of Anesthesiologists Score (OR = 0.550, $p = 0.013$), pre-fracture Barthel Index ([BI], OR = 1.019, $p = 0.012$) and risk for depression, as measured by the Geriatric Depression Scale, (OR = 0.896, $p = 0.013$). The probability of climbing stairs until discharge was influenced by the patient's age (OR = 0.840, $p < 0.001$), pre-fracture BI (OR = 1.047, $p = 0.042$), cognitive impairment, as measured by the mini mental state examination (OR = 1.182, $p = 0.008$), pre surgical hemoglobin (OR = 1.026, $p = 0.044$), time until surgery (OR = 0.961, $p = 0.023$), duration of surgery (OR = 0.982, $p = 0.014$), and surgery type (prosthesis, OR = 4.545, $p = 0.001$). Similar variables influenced the Tinetti test at discharge.

Conclusion: While pre-fracture co-morbidities and function cannot be changed, the treatment of patients with cognitive impairment and depressive symptoms should be optimized. Efforts should be undertaken to ensure early surgery for all hip fractures.

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1. Introduction

Hip fractures are common in aging societies with an age-standardized incidence of more than 150/100,000 per year in developed countries (Kanis et al., 2012). The total number of these fractures is expected to increase considerably because of the demographic changes expected over the coming decades. Hip fractures are associated with functional decline, high morbidity rates, and premature death (Marks, 2010; Leibson, Tosteson, Gabriel, Ransom, & Melton, 2002). Therefore, hip fractures and their consequences have been identified as one of the most serious

healthcare problems affecting the elderly (Marks, 2010; Brauer, Coca-Perrillon, Cutler, & Rosen, 2009).

An important goal after hip fracture surgery is to achieve functional recovery with walking independence to help patients avoid institutionalization. Walking ability seems to be an early predictor of functional outcomes after femoral neck fractures (Lafamme, Rouleau, Leduc, Roy, & Beaumont, 2012). In a recent study, Bellelli et al. (2012) created a model that included the factors that have been shown to reduce the probability of walking independence at discharge from rehabilitation. These factors were cognitive impairment, limited function and activities of daily living, male sex, increased age, elevated or depressed body mass index (BMI), a greater number of drugs taken upon admission, and joint replacement for hip fracture repair compared to internal fixation.

Although it has been assumed that early mobilization is of great importance for the long-term function of these vulnerable patients,

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valid data regarding the factors influencing function and walking ability, particularly immediately after hip fracture surgery, are sparse.

To identify the independent factors influencing the course of mobilization, in this study, we prospectively observed the mobilization progress of hip fracture patients during the postsurgical period until discharge from acute care hospital.

2. Methods

At our acute care trauma department of the university hospital Marburg, we performed a prospective, observational, cohort study that included 402 patients older than 60 years with proximal femoral fractures (ICD-10 S72.0–72.2 [ICD-10]) (Buecking et al., 2013). The exclusion criteria for this study were polytrauma (ISS \geq 16) and malignancy-related fractures. The recruitment period ranged from April 1, 2009 to September 30, 2011.

For the present analysis, we used data from a subgroup of 392 patients. A total of 10 patients were excluded because patients' caregivers on admission indicated patients' inability to walk prior to the fracture.

All patients were examined by trained study staff (medical doctors or research study assistants), and the following patient characteristics were collected on admission: the socio-demographic data (e.g., age and sex), type of fracture; American Society of Anesthesiologists (ASA) score (Anesthesiologists ASo, 2010); and Charlson Comorbidity Index (CCI) (Charlson, Pompei, Ales, & MacKenzie, 1987).

2.1. Clinical data

During hospitalization the following data were documented: the interval between the hospital admission and surgery, surgery type (i.e., prosthesis or internal fixation), hemoglobin levels prior to the fracture, and surgery duration. The duration of inpatient treatment in our department, serious complications (grade IV complications according to Dindo's classification (Dindo, Demartines, & Clavien, 2004)) and in-hospital mortality were also documented.

2.2. Questionnaires

The following questionnaires were assessed on admission. The pre-fracture activity level was assessed by the Barthel Index (BI), according to the Hamburg Classification Manual (Lübke, Meinck, & Von Renteln-Kruse, 2004). This questionnaire contains 10 items with value from 0 to 15: Presence or absence of fecal incontinence, presence or absence of urinary incontinence, help needed with grooming, toilet use, feeding, transfers, walking, dressing, climbing stairs and bathing. These items reflect important activities of daily living. The full BI results in 0 (lowest activity level) to 100 points (highest activity level).

Pre-fracture Depression was evaluated using the 15-item short form of the Geriatric Depression Scale (GDS), with a value from 0 (not depressed) to 15 (highly depressed) (Sheikh and Yesavage, 1986). Patients have to answer general questions like "Are you basically satisfied with your life?" or "Do you feel you're your situation is hopeless?" either "yes" or "no". Patients with a GDS $>$ 4 suggest the presence of depressive symptoms to achieve high sensitivity in the depression screening (Almeida & Almeida, 1999).

Cognitive ability was assessed by the mini-mental status examination (MMSE) (Folstein, Folstein, & McHugh, 1975). The MMSE is a reliable 30-point screening test which contains questions in eight different categories. These categories are orientation (time and place), registration, attention and calculation, recall, language, repetition and complex commands. The questionnaire results in a score from 0 to 30 points. Based on the

German guideline for dementia the MMSE could – in combination with further tests of dementia – be divided in 4 groups: no cognitive impairment (27–30), mild cognitive impairment (20–26), and moderate dementia (10–19) und severe dementia (0–9) (AWMF, 2012).

2.3. Surgical treatment

We treated all hip fractures with surgery, either internal fixation or hip arthroplasty. The patients with displaced femoral neck fractures were treated with either bipolar hemiarthroplasty or total hip arthroplasty (THA), whereas the patients with non-displaced femoral neck fractures or stable trochanteric fractures were treated with dynamic hip screws. Intramedullary nails were used for internal fixation of unstable (sub-) trochanteric fractures.

2.4. Hip fracture rehabilitation protocol

Hip fracture patients were mobilized by our physical therapists. Additionally our nurses provided assistance during mobilization (e.g., for visits of the toilet). Mobilization was performed daily from the first postsurgical day, except on Sundays. The physiotherapist spent 30 min with the patients 2 times per day. Full weight bearing on the fractured hip was allowed immediately post-surgery. The range of motion was not restricted except for patients that had received THA (flexion max. 90°, internal rotation max. 0°). Various aids, such as canes, crutches, wheeled walkers, gait trainers, were used for mobilization (Buecking, Wack, Oberkircher, Ruchholtz, & Eschbach, 2012).

2.5. Level of mobilization

We defined 3 different mobilization levels:

1. *The ability to stand*: This was defined as standing beside the bed without help. The physiotherapist provided help while rising up if necessary.
2. *Walking ability*: This was defined as walking independently with different aids on the ward.
3. *Climbing stairs*: This was defined as the ability to walk stairs with the help of crutches. For safety reasons this was supervised by a physiotherapist.

Each day, the physiotherapist measured and documented whether the different mobilization levels were achieved. For the data analysis, we categorized whether the patients were able to stand 2 days post-surgery, were able to walk on the fourth day post-surgery, and were able to climb the stairs until the day before discharge.

Additionally, we measured patient mobility at discharge according to the Tinetti test (Tinetti, 1986). The Tinetti test is a clinical test for assessing static and dynamic balance abilities of a patient. It includes two parts of clinical examination, the balance test and the gait test. In total patients can reach a score up to 28 points. Patients with a score \geq 24 had a low risk of falls, whereas a score from 19 to 23 shows a moderate risk of falls and patients with a Tinetti score \leq 18 points had a high risk of falling.

Institutional review board approval was obtained from the ethics committee of the University of Marburg (AZ 175/08). All patients or their legal representatives provided written informed consent for study participation.

2.6. Statistics

The data were collected in a Filemaker[®] database (FileMaker Inc., Santa Clara, CA, USA). Double entry with a plausibility check was performed to monitor for data quality.

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