Injury, Int. J. Care Injured xxx (2018) xxx–xxx

Contents lists available at ScienceDirect

Injury

journal homepage: www.elsevier.com/locate/injury

Trajectory of physical activity after hip fracture: An analysis of community-dwelling individuals from the English Longitudinal Study of Ageing

Tariq Aboelmagd[a], Jack R. Dainty[b], Alex MacGregor[b], Toby O. Smith[c,*]

[a] Trauma and Orthopaedics Department, Royal Berkshire Hospital, Reading, UK
[b] Norwich Medical School, University of East Anglia, Norwich, UK
[c] Nuffield Department of Orthopaedics, Rheumatology and Musculoskeletal Sciences, University of Oxford, UK

ARTICLE INFO

Article history:
Accepted 7 February 2018

Keywords:
Physical activity
Fracture
Femur
Recovery
Longitudinal
Community-dwelling

ABSTRACT

Introduction: To analyse physical activity participation in a community-dwelling people in England with hip fracture the interval prior to fracture, in the fracture recovery period, and a minimum of two years post-fracture.

Materials and methods: 215 individuals were identified from the English Longitudinal Study of Ageing cohort (2002–2014) who sustained a hip fracture following a fall and for whom data were available on physical activity participation relating to the period pre-fracture, within-fracture recovery phase and post-fracture (minimum of two years). Physical activity was assessed using the validated ELSA physical activity questionnaire. Prevalence of 'low' physical activity participation was calculated and multi-level modelling analyses were performed to explore physical activity trajectories over the follow-up phase, and whether age, depression, gender and frailty were associated with physical activity participation.

Results: Prevalence of low physical activity participation within two years prior to hip fracture was 16.7% (95% Confidence Intervals (CI): 11.6% to 21.8%). This increased at the final follow-up phase to 21.3% (95% CI: 15.1% to 27.6%). This was not a statistically significant change ($P = 0.100$). Age ($P = 0.005$) and frailty ($P < 0.001$) were statistically significant explanatory variables ($P = 0.005$) where older age and greater frailty equated to lower physical activity participation. Neither gender ($P = 0.288$) nor depression ($P = 0.121$) were significant explanatory variables.

Conclusion: Physical activity levels do not significantly change between pre-fracture to a minimum of two years post-hip fracture for community-dwelling individuals. This contrasts with previous reports of reduced mobility post-hip fracture, suggesting that 'physical activity' and 'mobility' should be considered as separate outcomes in this population.

Introduction

Hip fractures are a major challenge for individuals who sustain them and for health services worldwide. Approximately 65,000 hip fractures occur each year in England, Wales and Northern Ireland [1]. Patients who sustain a hip fracture are typically elderly and frail, and their one-year post fracture mortality is reported to be as high as 30% [1,2].

Physical activity can been defined as any bodily movement produced by skeletal muscle that requires energy expenditure [3], and is a fundamental factor contributing to an individuals' health and wellbeing. Physical inactivity is the fourth leading risk factor for mortality globally [3]. Physical activity has been advocated to improve bone mineral density, reduce the risk of developing type 2 diabetes, breast cancer, dementia, obesity and depression [4]. Public Health England [5] recommend that people over the age of 65 years participate in at least 150 min of moderate intensity activity per week. However only 58% of men and 52% of women aged 65 to 74 years old, and 43% of men and 21% of women aged 75–84 years old in England meet these recommendations [6].

The United Kingdom National Health Survey has shown that physical activity levels decline with age [6]. Patients with hip fracture are particularly vulnerable to inactivity with previous literature demonstrating that mobility reduces following hip

* Corresponding author at: Nuffield Department of Orthopaedics, Rheumatology and Musculoskeletal Sciences, Botnar Research Centre, Nuffield Orthopaedic Centre, Windmill Road, Oxford, OX3 7LD, UK.
E-mail address: toby.smith@ndorms.ox.ac.uk (T.O. Smith).

https://doi.org/10.1016/j.injury.2018.02.010
0020-1383/

fracture [7]. This decline has been estimated where approximately 43% of people following hip fracture do not reach their pre-fracture level of mobility [7]. However, it remains unclear whether physical activity *per se*, rather than just mobility, changes before compared to after a hip fracture and how these may change over time, and what pre-fracture patient characteristics may be associated with post-fracture physical activity levels. The purpose of this study was to answer these questions using data from the English Longitudinal Study of Ageing (ELSA).

Materials and methods

ELSA cohort

Data were drawn from the ELSA cohort. The ELSA cohort study was initiated in 2002. This is a prospective cohort study of English community-dwelling adults born on or before February 29th 1952, and was designed to examine the relationship between health, economic position and activity, social participation, productivity, networks and support [8,9].

From the 2002/2003 inception, participants are contacted every two years for a follow-up interview. It is a nationally representative sample of the non-institutionalised population, living in England, aged 50 years or older at the initial interview [8]. A total of 11,391 participants were recruited at the first data collection phase (Wave 1). The waves analysed in this study co-incided with the 2004/2005 to 2014/2015 follow-up phases.

Ethical approval was obtained from the National Research Ethics Service (MREC/01/2/91). Anonymised unlinked data for this sample was provided by the UK Data Service.

Participant identification

In this present analysis, we identified all people who self-reported that they had sustained a surgically managed hip fracture. Data were collected to categorise the trajectory of each participant's physical activity levels in the wave prior to the hip fracture (within two years), the wave when the hip fracture occurred, and the subsequent wave (minimum of two years).

Data collection

The primary outcome measure to estimate physical activity was the self-reported ELSA physical activity questions (ELSA-PAQ) where participants were asked how often they engaged in vigorous, moderate or mild physical activity [10,11]. For each type of activity, participants responded either as being: very active (more than once a week), active (once a week), moderately active (one to three times per month), and inactive (hardly ever/never). This method has been previously used to determine the level of physical activity participation undertaken by older people [10,11], and has demonstrated excellent convergent validity within this population [12]. From this measure, a summary index of physical activity was derived as described by Garfield et al. [10], by summing responses to the three physical activity items each dichotomized around the frequency cut-point of once a week or more often. Using this approach, physical activity was analysed as: (1) sedentary (mild exercise one to three times a month, no moderate or vigorous activity); (2) low (mild, but no vigorous activity at least once a week); (3) moderate (moderate activity more than once a week, or vigorous activity between once a week to one to three times a month); and (4) high (heavy manual work or vigorous activity more than once a week).

Baseline data were taken from the pre-fracture assessment on age, gender and ethnic classification (white/non-white). Self-reported depressive symptoms were assessed using the eight-item version of Centre for Epidemiologic Studies Depression (CES-D) scale, with a cut-off value of four to classify someone with depressive symptoms [13]. Finally, the ELSA Frailty Index (ELSA FI) was calculated [14,15]. This is a validated measure of frailty and has been reported as a predictor of mortality and institutionalisation [16,17,18]. It includes data on functional and sensory impairments, self-reported comorbidities, self-rated health and global cognitive function. Through this, 'robust' participants had an ELSA FI score of <0.2, 'pre-frail' were 0.2-0.35 and 'frail' were >0.35 (Wade et al., 2016).

Data analysis

We analysed the data descriptively with summary statistics. Physical activity was assessed by determining the prevalence of 'low' participation in physical activity with 95% confidence intervals calculated for baseline and each of the follow-up phases.

Multilevel modelling approach was applied to take account of the lack of independence within the data. The method was used to determine whether the physical activity differed (significantly) between any two 'Time' points (levels = pre-fracture phase, fracture/recovery phase, post-fracture follow-up phase). Random intercept models (fixed slope) were compared to random intercept and (random) slope models. In all cases, the random intercept models (fixed slope) were preferred (due to model parsimony/best fit tests). Change of physical activity over time was assessed between the three consecutive time periods (Time = base (pre-fracture phase), Time = during (recovery phase), Time = post (minimum of two years post-fracture follow-up phase)). 'Age' (continuous), 'Gender' (factor: male/female), 'Depressed' (factor: self-reported yes/no) and 'ELSA Frailty Index" (continuous) were included as explanatory variables (in addition to the factor variable, "Time") to explain some of the other variation in physical activity participation. We performed an age-stratification analysis where change in physical activity was stratified into two halves (50 to 72 years versus 73 to 89 years) by reference to the median age (72 years).

All analyses were performed using the R Statistics programme (R Foundation for Statistical Computing, Vienna, Austria) using the "lmer" function in the 'lme4' package.

Results

Of the 11,391 participants at inception, 280 single hip fractures were surgically managed during the study time-frame. Of these, full data were avaliable at the three follow-up phases for 215 participants. Accordingly 65 participants were excluded from the analysis due to missing data. The demographic characteristics of these participants is presented in Table 1. This included 80 males and 135 females with a mean age of 71.8 years. The mean ELSA Frailty Index at pre-fracture assessment was 0.23 indicating the cohort had a mean index which was 'pre-frail'.

Prevalence

The prevalence of 'low' physical activity pre-fracture was 16.7% (95% CI: 11.6% to 21.8%). This increased at the post-fracture follow-up phase to 21.3% (95% CI: 15.1% to 27.6%). This trend was not observed for those in age 50 to 72 year old age-stratified analysis (pre-fracture: 10.9% vs. final follow-up: 9.8%), but the prevalence of 'low' physical activity participation did increase in those aged 73 to 89 years (pre-fracture: 17.0% vs. post-fracture follow-up phase: 33.8%). This indicates that there is a large difference in prevalence in 'low' physical activity at final follow-up between the two age groups (17.0% aged 50 to 72 years versus 33.8% aged 73 to 89 years).

Please cite this article in press as: T. Aboelmagd, et al., Trajectory of physical activity after hip fracture: An analysis of community-dwelling individuals from the English Longitudinal Study of Ageing, Injury (2018), https://doi.org/10.1016/j.injury.2018.02.010