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Research

Falls and fear of falling predict future falls and related injuries in ambulatory individuals with spinal cord injury: a longitudinal observational study

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KEY WORDS

Incomplete spinal cord injury
Accidental falls
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ABSTRACT

Question: What is the 1-year incidence of falls and injurious falls in a representative cohort of community-dwelling ambulatory individuals with chronic spinal cord injury? What are the predictors of recurrent falls (more than two/year) and injurious falls in this population? **Design**: One-year longitudinal observational multi-centre study. **Participants**: A representative sample of 68 (of 73 included) community-dwelling ambulatory individuals with traumatic SCI attending regular follow-up programs at rehabilitation centres. **Outcome measures**: Primary outcome measures were incidence and predictors of recurrent falls (more than two/year) and injurious falls reported every 2 weeks for 1 year. **Results**: A total of 48% of participants reported recurrent falls. Of the 272 reported falls, 41% were injurious. Serious injuries were experienced by 4% of participants, all of whom were women. Multivariate logistic regression analysis showed that recurrent falls in the previous year (OR = 111, 95% CI = 8.6 to 1425), fear of falling (OR = 6.1, 95% CI = 1.43 to 26) and longer time taken to walk 10 m (OR = 1.3, 95% CI = 1.0 to 1.7) were predictors of recurrent falls. Fear of falling (OR = 4.3, 95% CI = 1.3 to 14) and recurrent falls in the previous year (OR = 4.2, 95% CI = 1.2 to 14) were predictors of injurious falls. **Conclusion**: Ambulatory individuals have a high risk of falling and of fall-related injuries. Fall history, fear of falling and walking speed could predict recurrent falls and injurious falls. Further studies with larger samples are needed to validate these findings. **[Jørgensen V, Butler Forslund E, Opheim A, Franzén E, Wahman K, Hultling C, Seiger Å, Ståhle A, Stanghelle JK, Roaldsen KS (2017) Falls and fear of falling predict future falls and related injuries in ambulatory individuals with spinal cord injury: a longitudinal observational study. *Journal of Physiotherapy* XX: XX-XX]**

Introduction

Falls are common in ambulatory people with spinal cord injury (SCI). Reported incidences vary between 30 and 75%.[1–7] However, the large age span and a high proportion of risk takers[8] must be considered when studying falls in this population. The increasing number of ambulatory individuals with incomplete SCI and their increasing age at injury in the Western world[9,10] have raised concerns about falls and their adverse consequences. Reports of the incidence of fall-related injuries needing medical attention vary between 2 and 20%.[3–5,11,12] As injurious falls may increase with number of falls,[13] it is important to identify recurrent fallers. Moreover, infrequent or isolated falls are more unpredictable than recurrent falls, which are more likely linked to underlying neurological and musculoskeletal problems.[14]

A few studies have sought to establish predictors of falls.[3,7,15–17] The predictors that have been described include level of ability,[2,3,7,12,15] exercise level,[2,6,18] comorbidity, physical health, quality of life,[7,11,17,18] and fear of falling.[2] However, it is believed that the effect of challenging outdoor conditions during wintertime (as are common in Nordic countries) has not yet been studied.

Thus far, research findings are inconclusive, because previous fall studies in this population have been limited by small samples,[4,5] as well as weaknesses and diversity in both study designs[3,6,11,12] and recruitment processes.[2–7] Thus, incidence and predictors of falls and fall-related injuries have yet to be established.[19]

Therefore, the research questions for this longitudinal observational multi-centre study were:

1. What is the 1-year incidence of falls and injurious falls in a representative cohort of community-dwelling ambulatory individuals with chronic SCI?
2. What are the predictors of recurrent falls (more than two/year) and injurious falls in this population?

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Methods

Design

This 1-year, prospective study was part of a multi-centre study, conducted at Sunnaas Rehabilitation Hospital, Norway, and Rehab Station Stockholm/Spinalis, Sweden, called the Spinal Cord Injury Prevention of Falls (SCIP FALLS) Study. Participants were consecutively recruited between February 2013 and May 2014 in connection with a regular check-up in the systematic life-long follow-up program offered to all patients with SCI in the catchment areas of South-East of Norway and Greater Stockholm. The reporting of this study was guided by the TRIPOD[20] and STROBE[21] statements.

Participants and centres

Participants constituted the ambulatory subgroup of the SCIP FALLS Study (Figure 1). Data were collected in parallel in Norway and Sweden by two physiotherapists with >15 years of experience in SCI rehabilitation. The inclusion criteria were: traumatic SCI; being ≥1 year post injury; being aged ≥18 years; having the ability to cooperate and understand Norwegian/Swedish in speech and writing; and walking independently with or without walking aids for ≥75% of time for mobility needs,[22] according to the participants' own judgment of their ratio of wheelchair use to walking (0:100, 75:25, 50:50, 25:75 or 100:0). Five participants who stated that their ratio was 50:50 were discussed, and the research group classified them as ambulatory. The exclusion criteria were: SCI below L5 level or classified as American Impairment Scale (AIS) E (normal sensory and motor functions).[23] All participants gave written informed consent after receiving oral and written information.

The participants' characteristics (n = 68) are presented in Table 1. A total of 42 participants (62%) had a cervical lesion, 18 (27%) a thoracic lesion, and eight (12%) a lumbar lesion. Two participants (3%) were classified as AIS A, one (2%) as AIS B, three (4%) as AIS C and 62 (91%) as AIS D.[23] Twenty-nine participants (40%) used lower limb orthotic aids, 13 (19%) used walking aids indoors, while 26 (38%) used walking aids and five (7%) a wheelchair when moving outdoors.

Data collection

Outcomes

The outcomes of interest were falls and fall-related injuries. A fall was defined as 'an unexpected event in which the participants come to rest on the ground, floor, or lower level'.[24] Injurious falls were defined as falls leading to any kind of physical injury classified as: serious (medically recorded fracture, head or internal injury requiring accident and emergency or inpatient treatment); moderate (wounds, bruises, sprains, cuts requiring a medical/health professional examination such as physical examination, x-ray, suture); minor (minor bruises or abrasions not requiring health professional assistance, reduction in physical function (eg, due to pain, fear of falling), fear of falling for at least 3 days); or no injury (no physical injury detected).[25]

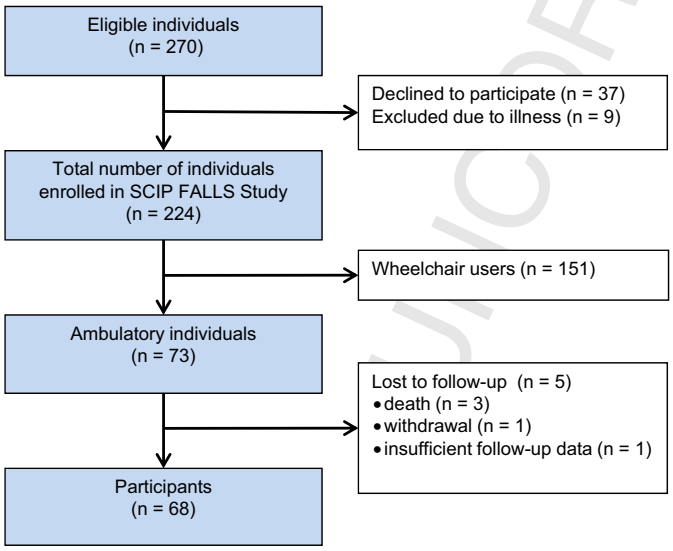

Figure 1. Participant flow in recruitment and follow-up.
SCIP FALLS Study = Spinal Cord Injury Prevention of Falls study.

Falls were monitored for 1 year by sending a text message via an online short message service (SMS) survey company[a] every second week, asking: 'Have you fallen in the past 2 weeks?' Participants who failed to answer this SMS and a reminder SMS sent 2 days later were contacted by telephone. If a participant's SMS reply was 'yes', a structured telephone interview was conducted within a week, focusing on number of falls, why, how, when and where they fell, as well as on possible injuries. All participants were telephoned 4, 8 and 12 months after baseline to maintain compliance and collect fall data.

Predictors

Due to the lack of consistent knowledge on falls and fall risk in ambulatory individuals with SCI, this study was exploratory. Hence, predictors were not selected a priori. Rather, data on a range of possible predictors were collected for the SCIP FALLS Study[7] based on previous studies (see Appendix 1 on the eAddenda). At a structured interview, the following data were recorded: socio-demographic data, injury-specific factors, secondary SCI conditions, number of prescription medications, history of recurrent falls in the previous year, ability to get up from the ground by oneself, fear of falling, monthly alcohol use, quality of life, and risk willingness. Clinical assessments included the International Standards for Neurological Classification of Spinal Cord Injury, use of walking aids, muscle strength in the lower extremities, functional independence, walking ability, balance, and exercise habits. Self-administrated questionnaires covered concerns about falling, fatigue, anxiety and depression, as well as health-related and general quality of life.

Data analysis

Thirty-nine falls directly related to sports activities (skiing, ice hockey and ball games) were excluded from the analysis due to the deliberate and greater risk of falling during these activities compared with normal everyday activities. Participants were categorised by their number of falls, dichotomised as zero to two falls (infrequent falls) or more than two falls (recurrent falls).[26–28] Falls were dichotomised as non-injurious or injurious.

Missing data for outcome and predictor variables were rare (<2% for any measure) with one exception: the Timed Stands Test could not be performed by 13 participants (19%) due to muscle weakness and was thus omitted from the multivariate analysis. Missing data on the Fall Efficacy Scale-International were replaced by the individual mean value if two or less items were missing. If more than two items were missing, then the sum score was not calculated. Other missing data were not imputed. As 82% of participants achieved the top score, the Walking Index for SCI was not used in the multivariate models. Answers to at least 66% of the SMS were required for inclusion in analysis.

Between-group differences were analysed using: the Student's *t*-test for normally distributed continuous data; the Mann-Whitney U test for non-normally distributed continuous and ordinal data; and the Chi-squared test for nominal data. *P*-values ≤0.05 were considered significant. The Spearman's rank correlation coefficient was used to assess correlations. Variables with a correlation coefficient <0.6 were entered into the bivariate logistic regression analysis (Table 2). If several variables assessed similar constructs, then the one with the lowest *p*-value was entered. The two predictive variables from our retrospective study[7] – 'ability to get up by oneself' and general quality of life – were included.

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