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SHORT COMMUNICATION

PERCEIVED INDEPENDENCE AND LIMITATIONS IN RISING AND SITTING DOWN AFTER REHABILITATION FOR A LOWER-LIMB AMPUTATION

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Objective: **To study perceived independence in rising and perceived limitations in rising and sitting down in persons after a lower-limb amputation and the relationship of these perceptions with personal and clinical characteristics.**
Design: **Cross-sectional study.**
Subjects/patients: **Persons with a lower-limb amputation wearing a prosthesis (*n* = 172).**
Methods: **Perceived independence in rising was assessed with the Locomotor Capabilities Index. Limitations in rising and sitting down were assessed with the Questionnaire Rising and Sitting down. Multivariate logistic and linear regression analyses, respectively, were used to investigate the associations between independence and limitations in rising and sitting down, and personal and clinical characteristics.**
Results: **Of the participants, 91% and 47% perceived independence in rising from a chair and rising from the floor, respectively. Older participants and women perceived less independence in rising. Participants perceived marked limitations in rising and sitting down, with those rehabilitated in a nursing home perceiving more limitations.**
Conclusion: **After a lower-limb amputation, most persons wearing a prosthesis are able to rise independently from a chair, but many perceive decreased independence in other forms of rising, especially older participants and women. Participants, especially those rehabilitated in a nursing home, perceive considerable limitations in rising and sitting down. However, in those patients rehabilitated in a nursing home these limitations may be due to indication bias.**

Key words: mobility; questionnaires; amputation; activities of daily living; rising and sitting down.

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INTRODUCTION

Although rising and sitting down are prerequisites for regaining walking mobility after a lower-limb amputation (LLA), and rising manoeuvres can hardly be avoided, studies focusing on limitations in rising and sitting down in persons with a LLA are scarce. Questions about rising and sitting down in persons with a LLA are included only in more comprehensive questionnaires (1, 2) and only superficially assess the limitations in rising and sitting down.

Important aspects of rising and sitting down in persons with a LLA are perceived independence in rising and perceived limitations in rising and sitting down. If a person does not perceive independence during rising, he or she may become dependent on an adapted chair, may not be able to rise without assistance, or might have to move to a nursing home because transfers and walking become impossible without assistance (3). If a person perceives many limitations in rising and sitting down, he or she will avoid rising and sitting down, which will lead to diminished mobility or even isolation.

Little is known about factors that influence rising and sitting down in persons with a LLA. Studies addressing test-based performance in rising and sitting down by persons with a (mainly) non-vascular transfemoral LLA, indicate that standing up is performed with minimal loading of the prosthetic leg (4, 5). Also, in persons with a transtibial amputation, loading of the prosthetic limb has been found to be strongly diminished (6). It is likely that, when rising and sitting down, the "sound" leg is mainly used to perform these activities (4). In a study, addressing self-reported perception, persons with a LLA of older age or those who were rehabilitated in a nursing home perceived more limitations in rising and sitting down than younger people and those rehabilitated in a rehabilitation centre (7).

The first objective of this study was to describe perceived independence in rising and perceived limitations in rising and sitting down in persons with a LLA at the end of rehabilitation treatment. The second objective was to analyse the relationship between independence and limitations in rising and sitting down, and personal and clinical characteristics.

METHODS

Participants

Participants were persons with a recently performed LLA, who underwent immediate rehabilitation. They were recruited at the end of their multidisciplinary rehabilitation treatment, with involvement of physical therapy,

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occupational therapy, prosthetists and, if necessary, social work. The rehabilitation treatment programmes of all participants were comparable, but individualized in intensity and frequency according to the (physical) capabilities of the participant. The first group consisted of patients at the end of their outpatient rehabilitation treatment (in some cases this had been preceded by inpatient rehabilitation) in the rehabilitation centre of s'Hertogenbosch (rehabilitation centre group). The second group consisted of patients directly after discharge from inpatient or outpatient rehabilitation treatment in nursing homes in the region s'Hertogenbosch (nursing home group). These 2 groups encompassed all persons with a LLA undergoing rehabilitation treatment in this region. They had to meet the following inclusion criteria: aged ≥18 years; currently wearing a prosthesis; and able to understand and complete questionnaires.

The study protocol was approved by the research ethics committee of Jeroen Bosch Hospital, s'Hertogenbosch. All participants provided informed consent.

Procedure

The rehabilitation centre group received a questionnaire about rising and sitting down from the therapists on the second-to-last day of treatment in the rehabilitation centre. They were asked to complete the questionnaire at home and bring it with them on the last day of treatment. The nursing home group received the questionnaire during their first follow-up appointment in the rehabilitation centre. They were asked to complete the questionnaire at home, and return it by post. This questionnaire comprised, among other things, questions about perceived independence in rising, and perceived limitations in rising and sitting down.

Measurements

Ability to rise independently. To measure perceived independence in rising, we used 3 questions of the Dutch version of the Locomotor Capability Index (LCI) (1, 8) specifically addressing this concept (Appendix I). The construct validity and test-retest reliability of each of the 3 questions has been found to be good (1).

Limitations in rising and sitting down. To measure the perceived limitations in rising and sitting down, we used the improved Questionnaire Rising and Sitting down (QR&S) (9, 10). The QR&S contains 39 items with dichotomous response options (yes box marked/yes box not marked). The sum score is based on the 1-parameter logistic model and standardized (range 0–100), with higher scores indicating less limitation. The QR&S is a unidimensional scale. It has good fit with a parametric item response theory model, the 1-parameter logistic model (10), good intra-test reliability and good content validity. The QR&S shows good construct validity (7 of 8 hypotheses not rejected) and test-retest reliability (intraclass correlation coefficient = 0.84) in persons with a LLA (7).

Personal and clinical characteristics. Data on personal (age, sex) and clinical variables (amputation cause and level, type of prosthetic knee and foot, and co-morbidities) were extracted from medical records. The Functional Comorbidity Index (FCI) (11) was assessed to rate the number of comorbid conditions. The FCI consists of a list of 18 items addressing several diagnoses, the presence of which (yes/no) is scored. The sum score is calculated by counting the items scored with "yes". A study examining the construct validity of the FCI has shown that physical functioning decreases with an increase in the FCI score (r = –0.47) (11). To obtain the most reliable FCI score, 2 investigators (FAdL and an independent physician) scored the presence of all 18 diagnoses independently, and, in case of disagreement, each score was discussed until consensus was reached.

Data analysis

For statistical analysis, rising was dichotomized into independent ("able alone") vs not independent; age was centred at 65 years to make the results clinically interpretable. Other personal and clinical variables were dichotomized (Table I).

With the ability to rise independently in all 3 questioned circumstances as the outcome, the personal and clinical characteristics were univariately tested for their association, using non-parametric statistics. The level of significance was set at $p < 0.05$. Associated variables ($p < 0.1$) were subsequently entered into a logistic regression as predictors. Through backward stepwise elimination, the non-contributing variables ($p \geq 0.1$) were excluded.

With limitations in rising and sitting down as the outcome, associations were tested using parametric and non-parametric statistics as appropriate. Associated variables ($p < 0.1$) were subsequently entered

Table I. *Patient characteristics and univariate analysis of independence in rising and limitations in rising and sitting down*

Patient characteristics	*n* (%)	Independence in rising *n*/total (%)	Limitations in rising and sitting down: sum score: Mean (SD)
Personal characteristics			
Age, years		$p < 0.001$*	$p = 0.025$***, r = –0.171
< 50 years	23 (13)	16/23 (70)	47 (18)
50–59 years	40 (23)	26/39 (65)	50 (12)
60–69 years	51 (30)	18/50 (35)	48 (15)
> 70 years	58 (34)	12/58 (21)	42 (18)
Sex		$p = 0.035$**	$p = 0.954$*
Women	50 (29)	15/50 (30)	46 (15)
Men	122 (71)	57/120 (48)	46 (17)
Clinical characteristics			
Amputation cause		$p = 0.052$**	$p = 0.262$*
Vascular	143 (83)	55/141 (39)	47 (16)
Non-vascular	29 (17)	17/29 (59)	43 (17)
Amputation level		$p = 0.270$**	$p = 0.231$*
Higher (HD, TF or KD)	66 (38)	25/65 (38)	45 (17)
Lower (TT or Syme)	94 (55)	44/93 (47)	48 (16)
Bilateral****	12 (7)	3/12 (25) ****	41 (16)****
FCI		$p = 0.002$**	$p = 0.971$*
0–3	103 (61)	52/103 (50)	46 (18)
≥4	67 (39)	18/66 (27)	46 (13)
Setting		$p = 0.007$**	$p = 0.026$*****
Nursing home	17 (10)	2/17(12)	37 (19)
Rehabilitation centre	155 (90)	70/153(46)	47 (16)
Prosthetic knee		$p = 0.002$**	$p = 0.482$*
Knee lock	26 (39)	4/26 (15)	46 (13)
Other	41 (61)	21/40 (53)	43 (19)
Prosthetic foot		$p = 0.181$**	$p = 0.096$*
Single-axis	82 (48)	30/81 (37)	44 (17)
Other	90 (52)	42/89 (47)	48 (15)

*Significance (2-tailed *p*) of independent *t*-test.
**Significance (2-tailed *p*) of Pearson χ^2 test.
***Significance (2-tailed *p*) of Pearson correlation coefficient.
****Not univariately analysed because of the small number of patients.
*****Significance (2-tailed) of Mann-Whitney *U* test.
Independence in rising was assessed using 3 questions of the Locomotor Capabilities Index: to get up from a chair, to pick up an object from the floor when standing up with their prosthesis, and to get up from the floor. Independence in rising was defined as able alone in all 3 circumstances. Limitations in rising and sitting down was assessed using the Questionnaire Rising and Sitting down. Higher scores indicate less limitation.
Numbers in second column (*n*) and third column (total) can differ due to incomplete data of 2 participants.
FCI: Functional Comorbidity Index; HD: hip disarticulation; TF: transfemoral amputation; KD: knee disarticulation; TT: transtibial amputation; SD: standard deviation.

into a linear regression. Through backward stepwise elimination, the non-contributing variables ($p \geq 0.1$) were excluded.

All statistics were calculated using SPSS 18.0 for Windows (SPSS Inc., Chicago, IL, USA).

RESULTS

Participants

A total of 172 persons with a LLA participated in the study. Three persons with a LLA were unwilling to participate. The mean and standard deviations (SD) age of the participants was 65 years (SD 12) (age range 37–92 years). The characteristics of the 172 participants are presented in Table I. Data regarding the comorbidity and the ability to rise independently were available for all but 2 participants, while data for the QR&S were available for all but 1 participant, who did not complete the questionnaire.

Ability to rise independently

The LCI questions showed that 91% of the participants were able to get up from a chair independently, 2% needed supervision, 6% needed help and 1% was unable. To pick up an object from the floor when standing up with their prosthesis was independently possible in 68%, with supervision in 3%, with help in 8% and unable in 21%. To get up from the floor was independently possible in 47%, with supervision in 4%, with help in 23% and unable in 26%. In total, 42% of the participants were able to rise independently in all 3 circumstances. Univariate analysis showed a relationship ($p \leq 0.05$) between perceived ability to rise independently and age, sex, number of comorbidities, rehabilitation setting and type of prosthetic knee (Table I), but not with level or cause of amputation. Multivariate logistic regression analysis showed that older participants and women perceived less independence in rising (Table II).

Limitations in rising and sitting down

On the QR&S, participants mean score was 46 (SD 16), indicating marked limitations. Univariate analysis showed a relationship ($p \leq 0.05$) between the perceived limitations in rising and sitting down and age and rehabilitation setting. Those rehabilitated in a nursing home had a mean score of 37 (SD 19) (Table I). Multivariate linear regression analysis showed that participants rehabilitated in a nursing home perceived more limitations in rising and sitting down (Table II).

DISCUSSION

This study showed that most persons with a LLA perceived independence in rising from a chair, but being less independence when getting up from the floor. They perceived marked limitations in rising and sitting down. Older participants and women more often perceived being dependent in rising. Those rehabilitated in a nursing home perceived more limitations in rising and sitting down.

The study population was the total number of persons with a LLA from the region s'Hertogenbosch. The study population is representative regarding cause and level of amputation in the whole of The Netherlands (12).

The ability to rise independently in the original Canadian study of the LCI was as follows: 92% could get up from a chair, 76% could pick up an object from the floor when standing up with their prosthesis, and 63% could get up from the floor independently (13). This is similar to our results. These results and the results of the multivariate analysis show that, alongside just learning to walk, more attention must be paid to task- and context-specific rehabilitation treatment, such as rising and getting up from the floor, especially in older participants and women.

The QR&S has been studied previously in hip disarticulation and hemipelvectomy amputees with a (higher) mean score of 54

Table II. *Multivariate logistic and linear regression analyses to predict outcome in rising and sitting down in persons with a lower-limb amputation*

Outcome variable	β	SE	OR (95% CI)	*p*-value	Nagelkerke R^2
Independence in rising (logistic regression)					
Predictors					0.33
Age centred 65 years[a]	–0.10	0.02	0.90 (0.87 to 0.94)	<0.001	
Sex (men/women)[b]	1.31	0.45	3.69 (1.53 to 8.92)	0.004	
Constant	–1.25	0.39	0.29	0.001	
Limitations in rising and sitting down (linear regression)					
Predictors					0.23
Age centred 65 years[c]	–0.18	0.11	(–0.40 to 0.03)	0.093	
Nursing home (yes/no)[d]	–8.65	4.20	(–16.94 to –0.36)	0.041	
Constant	47.18	1.29	(44.64 to 49.72)	<0.001	

Clinical interpretation:

[a]Every year older than 65 further reduces the ability to rise independently. The odds of a patient who is 75 years of age of rising independently is $(e–0.09)10 \approx 0.9010 \approx 0.35$ times less than that of someone who is 65 years of age.

[b]The odds of women rising independently is 3.7 times lower than men.

[c]Every year older than 65 further reduces the mean outcome in rising and sitting down. This mean outcome (range 0–100 with higher scores indicating less limitation) for a patient who is 75 years of age is $0.18 \times 10 = 1.8$ lower than for someone who is 65 years of age.

[d]Mean outcome of the limitations in rising and sitting down is 8.65 lower in persons treated in a nursing home than in persons treated in a rehabilitation centre.

SE: standard error; OR: odds ratio; CI: confidence interval.

(14). However, in this study, the participants had a lower mean age (9 years lower), a high percentage of tumours as cause of amputation, and had their amputation a long time ago (mean 23 years), thus having greater experience in rising and sitting down. This can explain the difference in score.

Multivariate regression analysis showed no correlation between perceived limitations in rising and sitting down and clinical characteristics, such as level of amputation, cause of amputation, and type of prosthetic knee or foot, in this study of perception in rising and sitting down.

Study limitations

This study has some limitations. First, we assessed only easily obtainable personal and clinical variables. We did not assess other variables that might influence rising and sitting down, such as muscle force or foot positioning (3). In future studies, these variables need attention in the assessment of rising and sitting down in persons with a LLA. Secondly, we included only those persons with a LLA who were wearing a prosthesis at the end of their treatment. Thus, we excluded more severely disabled persons with a LLA, persons who may also experience difficulty in rising and sitting down. Therefore, our results cannot be generalized to persons with a LLA who are not wearing a prosthesis. Finally, the difference in perceived limitations in rising and sitting down between the rehabilitation centre group and the nursing home group might be due to bias by indication: more disabled persons with a LLA are more frequently admitted to a nursing home.

Conclusion

A considerable number of persons with a LLA reported decreased ability in rising and sitting down, a prerequisite for walking with a prosthesis. In particular, women and those of advanced age perceive less independence in rising, and those rehabilitated in a nursing home perceive more limitations in rising and sitting down. Therefore, these sub-groups with a LLA require special attention when being trained in rising and sitting down.

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APPENDIX I. Questions in the Locomotor Capabilities Index concerning rising

	0	1	2	3
Get up from a chair	□	□	□	□
Pick up an object from the floor when you are standing up with your prosthesis	□	□	□	□
Get up from the floor (e.g. if you fell)	□	□	□	□

0 = unable; 1 = able if someone helps me; 2 = able if someone is near me; 3 = able alone.