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SHORT COMMUNICATION

COGNITIVE STATUS AND AMBULATORY REHABILITATION OUTCOME IN GERIATRIC PATIENTS

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Objective: **To determine the effect of admission cognitive status on gait and stair climbing rehabilitation outcome in geriatric patients.**
Design: **Before-after trial.**
Subjects: **A total of 179 geriatric patients (139 women and 40 men; age range 67–97 years) consecutively admitted to a geriatric inpatient rehabilitation regimen (mean length of stay 28.7 (standard deviation 13.9) days).**
Methods: **Assessment of admission cognitive status by the Mini-Mental State Examination (MMSE); determination of the ambulatory status before and after rehabilitation by the Performance-Oriented Mobility Assessment (POMA) and standardized judgements about stair climbing ability.**
Results: **Approximately two-thirds of the patients demonstrated functional ability improvements in at least 5 points at the individual level during rehabilitation (as measured by the total POMA scale (POMA-T)). However, at rehabilitation discharge cognitively impaired patients still demonstrated a 3.4 times (95% confidence interval = 1.4–8.6) higher chance of increased fall risk and only 24% of the cohort was able to negotiate stairs with slight or no limitations.**
Conclusion: **Although cognitively impaired patients demonstrated an functional overall intervention response comparable with cognitively intact patients the present study evidenced that the geriatric cohort with reduced mental status (MMSE < 17) are at greater risk of falling and have a greater need for supervision, both in hospital and at discharge.**

Key words: geriatric rehabilitation, gait analysis, stair climbing, cognitive status, outcome evaluation.

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INTRODUCTION

Healthcare providers who treat elderly patients are challenged to establish effective rehabilitation interventions. Although many older people are able to transfer and walk independently at around the time of discharge from inpatient rehabilitation, their mobility and especially their ability to negotiate stairs (1) are often still restricted. Cognitive impairment could be viewed as a possible obstacle in motor rehabilitation (2–4). However, the correlation between cognitive diminution and effective geriatric rehabilitation is still a matter of debate. While some authors have assumed that cognitive impairment, as manifested by low scores in mental status questionnaires, does interfere with active rehabilitation (5, 6), others have reported limited functional gains and a poor rehabilitation outcome (7–9).

Due to the importance of independent ambulation in the ageing population, the significant number of rehabilitation inpatients with cognitive deficits, and the effects of dementia on gait (10), this study was designed to examine further the extent to which cognitive status at admission affects the outcome of gait and stair climbing rehabilitation in geriatric patients.

METHODS

The study included a sample of 179 elderly inpatients (139 women and 40 men; age range 67–97 years) consecutively admitted to a local geriatric rehabilitation clinic. Diagnoses at admission included orthopaedic involvement (42%), internal medicine (46%), and general medical deconditioning and neurological conditions (12%). Patients took an average of 6.1 prescription medications at the time of admission (range 0–17). All patients were rigorously screened and recruited into the study by a single clinician. Patients with and without cognitive impairment were eligible. There was no attempt made to diagnose the cause of the cognitive impairment except to exclude delirium. Inclusion criteria were: at least 65 years of age; independently mobile; living in a private residence; ability to perform the motor tasks of the study, and to understand study instructions. Patients with acute neurological impairment (acute stroke, Parkinson's disease, paresis of lower limbs) or other severe physical or psychiatric illness (e.g. vestibular impairment, uncontrolled diabetes mellitus, acute myocardial infarction, substance abuse) were not included, nor were patients for whom discharge was planned within 10 days. Subsequent to a cognitive evaluation 24–48 h after admission, various motor tasks (balance, gait, stair ambulation) were rated before and after the inpatient rehabilitation regimen (mean length of stay 28.7 (standard deviation 13.9) days) by a single experienced observer who was blinded to the cognition strata. During rehabilitation, subjects participated on average in 12×30 min of physiotherapy, 6×20 min of ergotherapy and $13 \times$ of at least 20 min of ergometer exercises. The study, in part a usual clinical evaluation of treatment, was designed to be consistent with the revised Helsinki Declaration. All participants and their caregivers provided written informed consent.

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Cognitive status

Cognitive status was tested by the Mini-Mental State Examination (MMSE), a well-established, reliable, valid, and brief cognitive screening instrument (11). This easy-to-administer instrument examines attention, memory (orientation, recall of words, recognition of sentences, and drawings), and initiation and maintenance of verbal and motor responses. A total score of 30 points represents optimal performance. Age/education corrected reference values (12), usually used to decide if a patient should undergo further clinical and neurophysiological investigations aimed at determining whether the cognitive abilities of the patient have in fact deteriorated, were applied to stratify between cognitive unimpaired ($n = 109$) and impaired ($n = 70$) patients. Since anyone who scores below the standard cut-off of 17 is very likely to demonstrate a more severe degree of dementia, the impaired group was further divided into mild ($n = 36$) and severe ($n = 34$) cognitive impairment.

Ambulatory status

Ambulatory status was determined by the Performance-Oriented Mobility Assessment (POMA) and judgements about stair climbing performance. Concurrent validity for the POMA scales ($r = 0.64$–0.68) as well as the inter-rater and test-retest reliability for the POMA and its subscales were good ($r = 0.72$–0.93) (13). POMA has even been proved to be reliable and sensitive to changes in geriatric inpatients in case of dementia (14). The total POMA scale (POMA-T), used to describe and monitor balance and gait and to identify individuals who are at risk for falling, consisted of 8 balance items (POMA-B) and 8 gait items (POMA-G). Each item is scored on a 2- or 3-point scale, resulting in a maximum score of 28 on the POMA-T and maximum scores of 15 and 13 on the POMA-B and the POMA-G, respectively. Lower scores indicate poorer performance. A cut-off score of 19 or less was used for predicting a high risk of falling. Referring to Faber et al. (15), an intervention effect of at least 5 points at the individual level of the POMA-T was defined as the minimum functional gain to emphasize the difference between cognitively impaired and intact patients.

In addition to POMA, a standardized stair test required the subjects to ascend and descend a flight of steps (height 19 cm, depth 28 cm) one leg after another as fast and comfortably as possible. Performance was rated on a 4-point ordinal scale scoring system based on the subject's difficulty in performing the task and the use of the handrail for support and balance. Higher scores indicated better performance, zero indicated an inability to perform the task independently.

Statistical methods

Computations were made with a commercial statistics package (SPSS Inc., USA). Non-parametric testing (Kruskal-Wallis, χ^2 test) was used to determine differences in performance levels and frequencies between groups and tasks. $p < 0.05$ was regarded as significant.

RESULTS

Approximately two-thirds of all patients demonstrated functional ability improvements of at least 5 points at the individual level during rehabilitation (as measured by the POMA-T). The 95% confidence interval (CI) of the overall differences between the POMA-T admission and discharge scores ranged from 6.1 to 7.5 points (cognitive impairment: 5.8–7.9 severe, 5.6–9.8 mild, 5.7–9.3 unimpaired). Therefore, the Kruskal-Wallis test did not reveal significant group differences of gains in the POMA-T score. However, categorical testing demonstrated significant ($p < 0.05$) differences in the prevalence of increased fall risk (POMA-T < 20) at discharge in the 3 cognitive status groups (Table I), attributable to the discrepancy between the observed and expected frequencies in subjects with severe cognitive impairment (POMA-T ≥ 20: 6 vs 13; POMA-T < 20: 28 vs 21). Therefore, patients with MMSE scores below 17 had 3.4 times higher chance of increased fall risk at rehabilitation discharge (odds ratio = 3.4, 95% CI = 1.4–8.6) compared with cognitively mild and unimpaired study participants.

Table I. *Cognitive status compared with fall risk at admission and discharge*

	Risk of falling, POMA-T			
Cognitive status, MMSE	Admission ≥20 *n* (%)	Admission <20 *n* (%)	Discharge ≥20 *n* (%)	Discharge <20 *n* (%)
Unimpaired	17 (16)	92 (84)	48 (44)	61 (56)
Impaired				
Mild	7 (19)	29 (81)	14 (39)	22 (61)
Severe (<17)	2 (6)	32 (94)	6 (18)	28 (82)

MMSE: Mini-Mental State Examination; POMA-T: total Performance-Oriented Mobility Assessment scale.

The contingency table of the staircase examination also revealed significant differences ($p < 0.01$) in the proportion of cognitive impaired subjects demonstrating age-adequate stair climbing performance after rehabilitation (Table II). Although approximately 60% of the cognitively intact patients and 45% of the cognitively mildly impaired patients showed minor difficulties or unrestricted stair walking abilities at discharge, only 24% of the cognitively impaired cohort was able to negotiate stairs with slight or no limitations.

DISCUSSION

Functional, clinical and cognitive impaired conditions, together with age and interacting adverse clinical events, are retained as potential hints for sufficient rehabilitation results (16). However, in the present study the absolute rehabilitation gain of cognitively impaired patients was not different from that of intact patients. Because almost all of the geriatric patients improved their functional abilities during rehabilitation the findings suggest that patients' overall ability to perform functional activities or assist in self-care was enhanced at discharge. Findings are in agreement with others (3, 6, 17–18), who stated that poor cognitive status does not markedly impact on the potential for a positive overall rehabilitation response, although it may bear heavily on frailty (5). Because rehabilitation practice focused more on the performance of functional tasks than the recall or verbalization of skills it may, to some

Table II. *Admission cognitive status and stair climbing performance before/after inpatient rehabilitation*

	Stair climbing performance, *n* (admission/discharge)			
	Impaired			
Cognitive status, MMSE	Severe	Moderate	Slight	Unimpaired
Unimpaired	76/31	12/13	13/44	8/21
Impaired				
Mild	25/13	4/7	6/13	1/3
Severe (<17)	30/14	2/12	2/6	0/2

MMSE: mini-mental state examination

extent, account for the almost comparable rehabilitation gain of cognitively compromised patients. The recent findings in part also underline the potential of the current rehabilitation programme, since other motor interventions (19) proved to be of limited efficiency (20). Gorgon et al. (1) reported that around the time of rehabilitation discharge only a small number of older inpatients achieved a gait velocity adequate for street crossing or the ability to negotiate stairs. In the present study at rehabilitation discharge cognitively impaired patients were also characterized by a still increased risk of falling and a limited ability of safe stair ambulation. Thus, the present results also confirm that cognitive integrity impacts on functional ability and independent living. It appeared that absolute rehabilitation outcome by functional mobility measures seemed to be independent of cognitive status at admission, whereas the relative risk of falling depended on it. Although the present study failed to utilize regression analysis, the results correspond with other findings (7–8) and are also in agreement with Friedman et al. (2), who identified cognitive impairment as a predictor of gait rehabilitation improvement. The discrepancy to the research of Ruchinskas et al. (9), where cognitive condition did not predict discharge walking or stair climbing ability, may be attributed to assessment and outcome differences. Nevertheless, the continuously increased risk of falling is in line with a current review regarding the limited effectiveness of physical training on fall prevention in cognitively impaired patients (4). The continuing risk for ''unsafe'' ambulation may contribute to the burden of care and an increased likelihood of nursing home placement (7). Even so, the current results argue for the inclusion of cognitively impaired elderly in geriatric rehabilitation programmes. But caregivers, supervisors and insurers should be educated regarding the remaining restorative capacity and the safety awareness cognitively impaired patients deserve after hospital discharge.

A bias may be present in our study sample because those who are grossly demented are often excluded from rehabilitation admission. The drawback of the MMSE as a screening measure also has to be taken in consideration. As already mentioned (2, 5), it sums cognitive performance in several unrelated areas and does not substitute for a comprehensive neuropsychological battery that may better detect cognitive dysfunction.

In conclusion, although cognitively impaired patients demonstrated an overall intervention response comparable with cognitively intact patients, the present study evidenced that the geriatric cohort with reduced mental status are at greater risk of falling and have a greater need for supervision, both in the hospital and at discharge. In addition to the enhancement of treatment strategies to restore and maintain function in cognitively impaired patients, longitudinal studies should quantify the number of falls and accident events.

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