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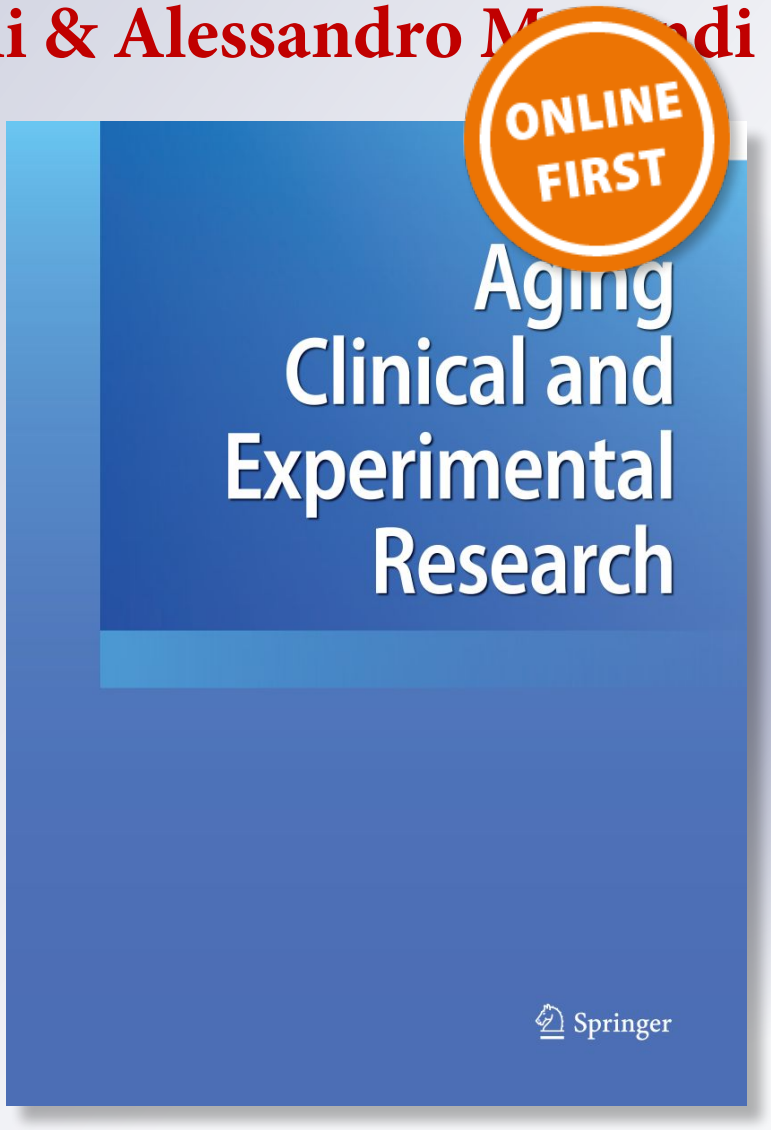
Aging Clinical and Experimental Research

e-ISSN 1720-8319

Aging Clin Exp Res
DOI 10.1007/s40520-017-0804-x



Springer

Aging Clin Exp Res
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SHORT COMMUNICATION

Why older people stop to drive? A cohort study of older patients admitted to a rehabilitation setting

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Received: 13 July 2017 / Accepted: 19 July 2017

Abstract The aim of this study is to describe the predictive factors of driving cessation at 6-month follow-up in older patients discharged from a rehabilitation setting and evaluated by an occupational therapist in a multidisciplinary team. Of 95 patients, at 6-month 27.4% ceased to drive. The reasons for driving cessation were a patients' voluntary choice (42.3%) or a choice of their family (23.1%), and only in 34.6% of the patients the license was revoked by a medical commission. In a multivariate analysis greater functional impairment—measured with the Timed Up and Go test—(OR 12.60, CI 2.74–57.89; $p < 0.01$) was the only predictor of driving cessation. This study shows that the ability to walk safely and independently is a significant predictor of driving cessation. The simple assessment of this factor using the TUG might be an easy screening tool to prompt a second level evaluation to accurately identify unsafe driving.

Keywords Driving · Older adults · Age · Functional impairment · Occupational therapy

Electronic supplementary material The online version of this article (doi:10.1007/s40520-017-0804-x) contains supplementary material, which is available to authorized users.

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Introduction

The Italian population counts 60 million of people and 20% of them is 65 years of age and older [1]. Among this group the 12.9% (i.e., 4,500,000 people), has a valid driving license [1]. The number of car accidents among this segment of population is about 10% [1]. Previous studies have shown that factors linked with car accidents could be used to draw attention on the risk factors for unsafe driving [2, 3]. Of these factors the most widely reported are caregiver's concerns, previous history of car accidents or citations, an infrequent use of the car, cognitive deficits, sleeping disorders, alcohol abuse, polypharmacy, visual, auditive and motor deficits [4–6].

On-road trial is the gold-standard parameter to evaluate the driving skills; nevertheless this test is expensive, long-lasting and not always accepted by the older person [7]. Additionally, there are different types of progressive diseases that interfere with the driving skills and, for this reason, have to be assessed serially. A test that evaluates unsafe driving in an efficient, reliable and inexpensive way is needed. Currently, there are no specific protocols to evaluate the driving skills in older people [7].

The aim of this study is to describe the clinical variables and the predictive factors for driving cessation among a population of older people admitted to rehabilitation setting.

Materials and methods

This is a prospective observational study carried between January 2012 and June 2014 on patients aged 65 and older consecutively admitted to the Department of Rehabilitation of the Ancelle Hospital (Cremona, Italy) and who drove a care independently before the index

Published online: 08 August 2017

hospitalization. Exclusion criteria included refusal to participate to the study, aphasia, coma. The local ethical committee approved the study protocol.

The subjects were assessed before rehabilitation discharge with a multidimensional screening including the evaluation of cognitive functions carried out by two psychologists (executive functions, CLOX 1; visual and spatial skills, CLOX 2 [8]; attention abilities with attentive matrices; global cognitive function, S-Mini Mental State Examination, S-MMSE). A deficit in executive functions was determined with a CLOX 1 score ≤10, attention deficits if the attentive matrix was ≤36. An evaluation of functional status was carried out by an occupational therapist (Lawton Index and Timed Up and Go Test, TUG [9]). A patient is considered at risk of falling if TUG test is ≥20 s.

A geriatrician assessed the presence of alcohol abuse using the Cage Questionnaire; polypharmacy (i.e., number of drugs ≥5); sleeping disorders with the Epworth Sleepiness Scale; visual and auditive deficits with the Snellen test and the whisper test, respectively. The closest family member underwent a structured interview (Supplementary Material S1) carried out by an OT to evaluate the patients' driving skills, the number of citations received during the 3 years preceding the screening, and the average kilometers driven per week [3].

Follow-up

Six months after the discharge the family member was interviewed with a telephonic follow-up, administered by an OT to investigate the use of the car.

Statistical analysis

Continuous variables are presented as mean ± standard deviation, while categorical data as number and proportions. The characteristics of patients according to driving cessation at 6-month follow-up were compared using a nonparametric test (Mann–Whitney)—when abnormal distribution was present—or the *t* student test. Chi-square test (Fisher's Test) was used for categorical variables. A multivariable logistic regression was used to determine the predictors of driving cessation at 6-month follow-up. In this model, we included all variables significantly different in the univariate analysis; age was categorized in tertiles according to its distribution. All statistical analyses were performed using SPSS (Statistical Package for Social Sciences) version 14, with alpha level set at 0.05.

Results

A total of 95 patients were included (Table 1). Functional deficits were identified with the TUG in 22 patients (23.2%). At 6-month follow-up 27.4% of patients ceased to drive (Table 1). The motivation underneath the driving cessation was a voluntary choice of the patients (42.3%) or a choice of their family (23.1%). Only 34.6% of the patients ceased to drive because of a revoked driving license. They had more executive functions deficits (61.5%), visual and spatial deficits (46.2%), attention deficits (34.6%) and walking difficulties (61%) as indicated by TUG scores.

The multivariate analysis found that the only independent predictor of driving cessation after 6 months was the presence of greater walking disability, as evaluated by the TUG (OR 12.60, CI 2.74–57.89; $p < 0.01$) (Supplementary material S2).

Discussion

This study shows that 27.4% of older patients ceased to drive at 6-months after discharge from a rehabilitation setting. The ability to walk safely and independently was the only independent predictor of driving cessation.

Cognitive deficits and age were not found to be associated with driving cessation. These results are partially in contrast with previous studies [6, 10]. The possibility that people with dementia continue to drive for some time after the diagnosis underlines the importance of a prompt cognitive screening. In previous studies, advanced age was found as an independent predictor of driving cessation.

This study innovatively shows that the ability to walk in a steady and functional way—evaluated with the TUG—could be considered an independent predictive factor for driving cessation. TUG evaluates a person's mobility including balance but also walking speed. It should be noticed that walking speed has been suggested as a sixth vital sign given the strong association between walking speed and adverse outcomes [11, 12]. Walking speed is indeed indicative of an individual's functional capacity and general health status [13].

Finally, one should not underestimate the relevance of driving cessation in this growing population [14]. Driving cessation exerts a strong impact on the risk of functional limitation [15]. Health care providers should look for appropriate intervention strategies to help older people to maintain the abilities required for safe driving and delay the functional limitation associated with driving cessation.

Our study presents strengths along with limitations. This study does not definitively validate the factors, which could significantly influence driving cessation due to the limited number of patients enrolled in the study. Future

Table 1 Characteristics of 95 patients according to driving cessation

Variables	Total ($n=95$)	Driving cessation at follow-up ($n=26$)	Still driving at follow-up ($n=69$)	p
Age (years)	74.24 ± 6.07	77.69 ± 6.46	72.94 ± 5.41	0.000
Female gender	31 (32.6%)	6 (23.1%)	25 (36.2%)	0.165
Admission diagnoses				
Orthopedic	42 (44.2%)	10 (38.5%)	32 (46.4%)	0.021
Gait disorders	37 (38.9%)	7 (26.9%)	30 (43.5%)	
Pulmonary	11 (11.6%)	7 (26.9%)	4 (5.8%)	
Cardiology	5 (5.3%)	2 (7.7%)	3 (4.3%)	
Reason for driving cessation at follow-up				
The patient voluntary stopped driving	–	11 (42.3%)	–	–
License revoked by a medical commission		6 (23.1%)		
Caregivers concerned for unsafe driving		9 (34.6%)		
Driving <100 km/week	61 (64.2%)	24 (92.3%)	37 (53.6%)	0.000
Car crashes (patients' fault)	13 (13.7%)	4 (15.4%)	9 (13.0%)	0.500
Number of citations	11 (11.6%)	4 (15.4%)	7 (10.1%)	0.349
Caregivers concerned for unsafe driving	27 (28.4%)	16 (61.5%)	11 (15.9%)	0.000
S-MMSE <25 (deficit) %	24 (25.3%)	13 (50.1%)	11 (15.9%)	0.001
CLOX 1 (<11 deficit)	34 (35.8%)	16 (61.%)	18 (26.1%)	0.002
CLOX 2 (<13 deficit)	17 (17.9%)	12 (46.2%)	5 (7.2%)	0.000
Attention Matrix (<30 deficit)	13 (13.7%)	9 (34.6%)	4 (5.8%)	0.001
Number of impaired IADLs before admission	0.63 ± 1.23	1.65 ± 1.44	1.25 ± 0.88	0.000
Timed up and go test TUG—seconds	15.91 ± 5.54	19.88 ± 7.56	14.41 ± 3.62	0.000
Deficit (score ≥20 s)	22 (23.2%)	16 (61.5%)	6 (8.7%)	
Auditory deficits	41 (43.2%)	21 (80.8%)	20 (29.0%)	0.000
Visual deficits	17 (17.9%)	11 (42.3%)	6 (8.7%)	0.000
Sleep disorders	10 (10.5%)	7 (26.9%)	3 (4.3%)	0.004
Alcohol (mean CAGE Questionnaire)	8 (8.4%)	3 (11.5%)	5 (7.2%)	0.380
Polypharmacotherapy	52 (54.7%)	19 (73.1%)	19 (73.1%)	0.023

studies should address how the OT could support older people who cease to drive in identifying alternatives ways to maintain their abilities.

Conclusions

This preliminary study suggests a screening protocol easy to administer. Since the functional analysis of cognitive and motor skills could be predictor of unsafe driving, a more advance second level analysis should be performed.

Acknowledgements We would like to thank Mirna Mai for her technical help with the translation during the writing process of this paper.

Author contributions Study conception and design- All authors. Acquisition of data—Pozzi, Morghen, Lucchi, Morandi. Interpretation of results—all authors. Manuscript draft- Pozzi. Critically revised the manuscript—all authors

Compliance with ethical standards

Conflict of interest The authors declare that they have no conflict of interest.

Ethical approval The local ethical committee approved the study protocol.

Funding/support None.

Human and animal rights All procedures performed including human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Informed consent Informed consent was obtained from all participants included in the study.

Sponsor role None.

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