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Cognitive impairment in older emergency department patients

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Chapter 3

Cognitive impaired older
patients and adverse outcomes
after a visit to the ED

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ABSTRACT

Objective: To investigate whether cognitive impairment, measured early after Emergency Department arrival and irrespective of its cause, is independently associated with functional decline or mortality after 3 and 12 months in older Emergency Department patients.

Design and setting: A prospective multicentre cohort study in all Acutely Presenting Older Patients visiting the Emergency Department (APOP-study) of three hospitals in the Netherlands.

Participants: 2130 patients, ≥ 70 -years.

Measurements: Data on demographics, disease severity and geriatric characteristics were collected during the first hour of the Emergency Department visit. Cognition was measured using the Six-Item Cognitive Impairment Test (6-CIT). Cognitive impairment was defined as 6-CIT ≥ 11 , self-reported dementia or the inability to perform the cognition test. The composite adverse outcome after 3 and 12 months was defined as a 1-point decrease in Katz Index of Independence in Activities of Daily Living (Katz-ADL) new institutionalisation or mortality. Multivariable regression analysis was used to assess whether cognitive impairment independently associates with adverse outcome.

Results: Of 2130 included patients, 588 (27.6%) had cognitive impairment at baseline and 654 patients (30.7%) suffered from adverse outcome after three months. Cognitive impairment associated with increased risk for adverse outcome (adjusted odds ratio (OR) 1.72, 95%CI 1.37-2.17). After twelve months, 787 patients (36.9%) suffered from adverse outcome. Again, cognitive impairment independently associated with increased risk for adverse outcome (adjusted OR 1.89, 95%CI 1.46-2.46). Odds ratios were similar for patients who were discharged home versus hospitalised patients.

Conclusion: Cognitive impairment measured during the early stages of Emergency Department visit, irrespective of the cause, is independently associated with adverse outcome after three and twelve months in older patients.

INTRODUCTION

The prevalence of impaired cognition in older Emergency Department (ED) patients ranges from 20 to 40%[1, 2]. Irrespective of its cause, impaired cognition is an important indicator that a patient has a vulnerable brain and may suffer from other comorbidities or previously unrecognized frailty[3] and may be at risk for developing delirium. However, impaired cognition is frequently underdiagnosed in the ED[4].

Impaired cognition can have numerous causes, either transient or pre-existing, such as dementia, delirium and circulatory failure as a result of severe disease causing hypo perfusion of the brain. Cognitive impaired patients have a higher chance of adverse outcome, such as functional decline[5], decreased quality of life[6], moving to a nursing home after being hospitalised[7] and revisits to the ED[8]. Emphasis in research in the ED has been on diagnosing delirium, for which multiple screeners exist[9, 10]. However, these screening tools are specific for delirium, for instance because they score the acute onset or fluctuation of symptoms, or inattention, which may not be present in a patient with pre-existing cognitive impairment. Arguably, also these patients may benefit from early recognition, for instance by implementing delirium prevention measures prior to the delirium occurring or because of communication needs of the cognitively impaired older patient. It is, however, unclear impaired cognition measured shortly (<1 hour) after the start of the ED visit, associates with adverse outcomes.

The goal of this investigation is to assess whether there is an independent association between impaired cognition, measured early during the ED visit, and functional decline or mortality after three and twelve months in older ED patients. We performed a large prospective, multicentre study in the Netherlands.

METHODS

Study design and setting

A detailed description of the of the Acutely Presenting Older Patient (APOP) study was previously published[11]. In short, during 3 consecutive months all patients aged 70-years and older visiting the Emergency Department were included in this multicentre prospective cohort study. One tertiary care hospital (Leiden University Medical Center) and two secondary care hospital (Alrijne Hospital and HMC Bronovo Hospital) participated.

Selection of participants

All patients were included consecutively. Inclusion criteria were age 70-years and older. Patients who were triaged for a need of immediate care (Manchester Triage category Red), patients with an unstable medical condition, due to denied permission of the

nurse or physician to enter the room and patients with a disturbed mental status without a proxy to provide informed consent were excluded. Also patients with a language barrier were not eligible. Please see Appendix 1 in the supplementary data on the journal website (<http://www.ageing.oxfordjournals.org>) for more information about the selection of participants. Written informed consent was obtained before inclusion from all participants. The medical ethics committee of the LUMC, Alrijne Hospital and HMC Bronovo Hospital approved the study.

Methods and measurements

For extended methods and measurements please see Appendix 1 in the supplementary data on the journal website (<http://www.ageing.oxfordjournals.org/>). Cognition was measured using the Six-Item Cognitive Impairment test (6-CIT)[12]. Patients were stratified for analyses: those with a 6-CIT ≤ 10 were considered to have normal cognition, 6-CIT ≥ 11 was considered cognitive impairment[13]. Also patients with self-reported dementia, or those unable to perform the 6-CIT were categorized as 'impaired cognition'.

Outcome

The main outcome of the study was composite adverse outcome, a composite of functional decline or mortality at three months follow up. Functional decline was defined as at least one point increase in Katz-ADL score or new institutionalisation, defined as moving to a nursing- or residential care home within three months after ED visit. Three months after the ED visit the patient was contacted by telephone. In case of no response after three attempts in three consecutive days, the general practitioner (GP) was contacted to verify phone number and living status and a letter was sent. Data concerning mortality was derived from the municipal records at three months follow-up. If a patient did not die within three months but no data on functional status was available, the patient was considered to have no composite adverse outcome. A similar endpoint was available at twelve months.

Analysis

Baseline characteristics are presented as mean with standard deviation (SD) in case of normal distribution, median with interquartile range (IQR) in case of skewed distribution or as numbers with percentages (%). Using univariable and multivariable regression analysis with endpoint 'cognitive impairment' the independent predictors of cognitive impairment in older ED patients were assessed. Chi-square test was used to assess crude associations between cognitive impairment and functional decline or mortality. Univariable and multivariable logistic regression was used to assess the association between cognition and functional decline or mortality after three months. Please see Appendix 1 for a more detailed description of used models and sensitivity analysis.

The level of significance was set at $P < 0.05$. Statistical analyses were performed using IBM SPSS Statistics package (version 23).

Declaration of sources of funding

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RESULTS

A total of 2130 patients participated in this study, which is a 83.4% inclusion rate of all eligible patients (please see the figure Appendix 2 in the supplementary data on the journal website <http://www.ageing.oxfordjournals.org/>).

Baseline characteristics

Table 1 shows the baseline characteristics of the study population. Of all included patients 588 (27.6%) had cognitive impairment according to a 6-CIT score ≥ 11 , of which 122 (5.7% of the total cohort) reported to be diagnosed with dementia (supplemental table S1). Compared to patients with normal cognition, patients with cognitive impairment were older (median 83 years vs median 78 years), less frequently high educated (13.2% vs 25.3%) and more often living in residential care or nursing home (20.7% vs 4.5%). Cognitively impaired patients arrived by ambulance more frequently (66.2% vs 45.7%), suffered from more urgent problems (triage urgency < 1 hour, 62.1 vs 54.6%), more often had a fall related visit (35.2% vs 24.3%), had more impairment on the other geriatric characteristics tests because they used a walking device more frequently (63.0% vs 36.1%), had a higher Katz-ADL score (median 1 vs median 0) and had more hours of home-care (median 2.5 vs median 0). Please see Appendix 3 for a baseline characteristics of patients, stratified by cognition status.

Characteristics of impaired cognition

Appendix 4 shows which predictors independently associated with the risk of having impaired cognition. Demographic characteristics like higher age and higher level of education, triage urgency, fall related ED visit and main complaint 'malaise', 'dyspnoea' or 'psychiatric complaint' were independent predictors of having impaired cognition. Finally, a higher Katz-ADL at baseline was independently associated with risk of having impaired cognition.

Table 1: Baseline characteristics of acutely presenting older patients, stratified by cognition status

Characteristics	All patients n=2130	Normal cognition ^a n=1542	Impaired cognition ^b n=588	p-value between groups
Demographics				
Age (years), median (IQR)	79 (74-85)	78 (74-83)	83 (77-88)	<0.001
Male	953 (44.7)	691 (44.8)	262 (44.7)	0.916
High education	466 (22.0)	389 (25.3)	77 (13.2)	<0.001
Living in a residential care/nursing home	191 (9.0)	69 (4.5)	122 (20.7)	<0.001
Hospital				
LUMC	751 (35.3)	561 (36.4)	190 (32.3)	0.185
Alrijne	881 (41.4)	631 (40.9)	250 (42.5)	
HMC Bronovo	498 (23.4)	350 (22.7)	148 (25.2)	
ED presentation characteristics				
Arrival by ambulance	1093 (51.3)	704 (45.7)	389 (66.2)	<0.001
Triage urgency				
> 1 hour	616 (28.9)	488 (31.7)	128 (21.8)	<0.001
< 1 hour	1207 (56.7)	842 (54.6)	365 (62.1)	
< 10 minutes	306 (14.4)	211 (13.7)	95 (16.2)	
Blood tests performed	1696 (79.6)	1216 (78.9)	480 (81.6)	0.155
Fall related ED visit	582 (27.3)	375 (24.3)	207 (35.2)	<0.001
Main complaint				
Minor trauma	669 (31.6)	475 (31.0)	194 (33.2)	<0.001
Malaise	398 (18.8)	260 (17.0)	138 (23.6)	
Chest pain	334 (15.8)	292 (19.1)	42 (7.2)	
Abdominal pain	214 (10.0)	167 (10.9)	47 (8.0)	
Dyspnea	240 (11.8)	157 (10.3)	93 (15.9)	
Other	112 (5.3)	88 (5.8)	24 (4.1)	
Syncope	101 (4.8)	72 (4.7)	29 (5.0)	
Major trauma	16 (0.8)	12 (0.8)	4 (0.7)	
Psychiatric complaint	21 (1.0)	7 (0.5)	14 (2.4)	
Geriatric characteristics				
Hours of home-care, median (IQR)	0 (0-3)	0 (0-3)	2.5 (0-7)	<0.001
Use of walking device	923 (43.5)	555 (36.1)	386 (63.0)	<0.001
Number of medications, median (IQR)	5 (3-8)	5 (3-7)	5 (3-8)	1.00
Katz-ADL, median (IQR) ^c	0 (0-1)	0 (0-1)	1 (0-3)	<0.001
6-CIT score, median (IQR) ^d	4 (2-9)	3 (0-6)	16 (13-21)	-

Data are presented as number, percentage unless noted otherwise.

Abbreviations: n=number, IQR=interquartile range, ED=Emergency Department, 6-CIT=6 Item Cognitive-Impairment-Test, Katz-ADL: Katz Index of Independence in Activities of Daily Living.

Missing values: use of walking device (n=8), level of education (n=10), triage category (n=1), main complaint (n=15), Katz-ADL (n=31), hours of home care (n=63), number of medications (n=1), and 6-CIT score (n=202).

^a6-CIT score 0-10, ^b6-CIT ≥ 11 , dementia or missing cognition. ^cHigher scores indicate higher dependency (range 0-6), ^dHigher scores indicate more cognitive impairment, cut-off ≥ 11 .

Association between impaired cognition and functional decline or mortality

In total 654 (30.7%) patients suffered from functional decline or mortality after three months. Older patients with impaired cognition had an increased risk (odds ratio (OR) 2.81, 95%CI 2.30-3.43) for functional decline or mortality after three months (table 2, figure 1). After adjustment for age, sex and education and additionally for disease severity, comorbidities and baseline functional status patients with impaired cognition had increased risk of functional decline or mortality (OR 1.72, 95%CI 1.37-2.17).

Table 2 also shows the association between impaired cognition and functional decline or mortality after twelve months. A number of 787 patients (36.9%) suffered from functional decline or mortality after twelve months. The risk of functional decline or mortality in patients with impaired cognition after 12 months was 3-fold higher when compared to those with normal cognition (OR 3.13, 95%CI 2.57-3.81, fully corrected model OR 1.91, 95%CI 1.52-2.39).

Table 2: The association between cognition and functional decline or mortality after three months in older Emergency Department patients

	Normal cognition ^a n=1542	Cognitive Impairment ^b n=588	p-value
Three months functional decline or mortality, n (%) ^c	375 (24.3)	279 (47.4)	<0.001
	OR (95%CI)		
Crude	1 (ref)	2.81 (2.30-3.43)	<0.001
Model 1 – corrected for age, sex and education	1 (ref)	2.18 (1.76-2.70)	<0.001
Model 2 – corrected for age, sex, education, number of medications, ambulance arrival & triage	1 (ref)	1.99 (1.60-2.46)	<0.001
Model 3 - corrected for age, sex, education, number of medications, Katz-ADL, ambulance arrival & triage	1 (ref)	1.72 (1.37-2.17)	<0.001
Twelve months functional decline or mortality, n (%) ^c	454 (29.4)	333 (56.6)	<0.001
	OR (95%CI)		
Crude	1 (ref)	3.13 (2.57-3.81)	<0.001
Model 1 – corrected for age, sex and education	1 (ref)	2.37 (1.93-2.93)	<0.001
Model 2 – corrected for age, sex, education, number of medications, ambulance arrival & triage	1 (ref)	2.24 (1.81-2.78)	<0.001
Model 3 - age, sex, education, number of medications, Katz-ADL, corrected for ambulance arrival & triage	1 (ref)	1.91 (1.52-2.39)	<0.001

Abbreviations: n=number, OR=Odds Ratio, 95%CI= 95% Confidence Interval, Katz-ADL: Katz Index of Independence in Activities of Daily Living, 6-CIT= 6-Item Cognitive Impairment Test.

^a6-CIT score 0-10, ^b6-CIT score 11-28, known dementia or missing 6-CIT ^cp-value calculated with chi-square test.

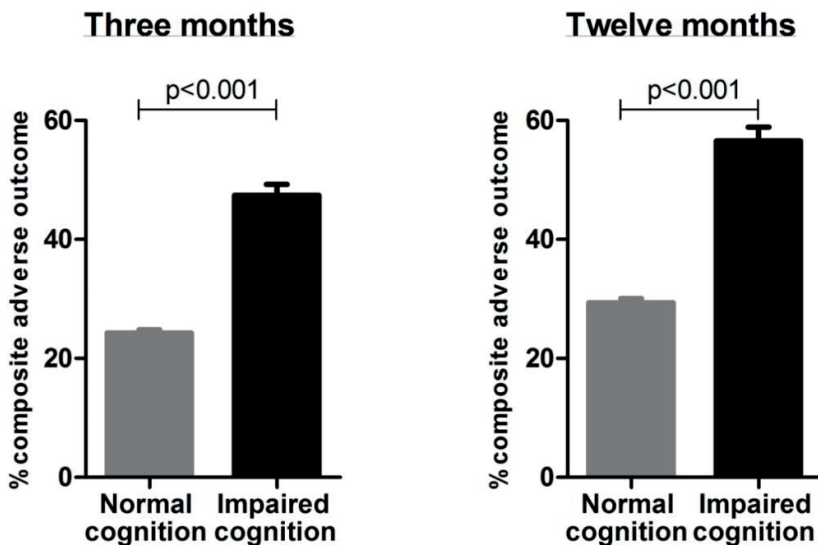


Figure 1: Incidence of functional decline or mortality for patients with normal and impaired cognition

Sensitivity analysis

We performed three sensitivity analyses. First, we studied the association between cognition and functional decline or mortality, using a lower cut-off point of ≥ 8 for the 6-CIT (Appendix 5). The total number of patients with impaired cognition in these analyses increased from 588 (27.6%) to 847 (39.7%). Impaired cognition was still independently associated, yet the associated risk was lower (OR 1.39, 95%CI 1.12-1.73). Predictors of impaired cognition and its association with functional decline or mortality were similar to the main analysis.

In a second sensitivity analysis, patients without dementia but in whom cognition could not be measured in the ED were excluded (Appendix 6). The results were comparable to the main analysis.

The third sensitivity analysis showed the association between cognitive impairment and functional decline or mortality, stratified for disposition (discharged home vs hospitalised, Appendix 7). Whereas the percentage of patients with cognitive impairment who suffered from functional decline or mortality after three months (38.2% vs 54.5%) was higher in the hospitalised patient group, the odds ratios for functional decline or mortality were very similar. Also, even when correcting for disease severity, comorbidity and Katz-ADL, the odds ratio for functional decline was similar for patients who were discharged home versus those who were hospitalised (OR 1.53, 95%CI 1.07-2.18 in discharged patients and OR 1.81, 95%CI 1.33-2.46 in hospitalised patients), indicating that cognitive impairment is evenly important to detect in patients discharged home from the ED. Please see the tables from Appendix 3-7 in the supplementary data on the journal website (<http://www.ageing.oxfordjournals.org/>).

DISCUSSION

Approximately a quarter of all older patients visiting the Emergency Department (ED) have impaired cognition. The main finding of this study is that cognitive impairment in older ED patients, irrespective of its cause, is associated with functional decline or mortality both after three months and twelve months, independent of demographic characteristics, disease severity, comorbidities and baseline functional status.

The results of a number of smaller studies in different populations and using different definitions of adverse outcome are in line with our finding that cognitive impairment is associated with functional decline or mortality. In one Canadian study including 1114 older ED patients with minor injuries, frailty and cognitively impaired older patients had an adjusted risk ratio for functional decline of 1.89 (95%CI 1.38-2.59) after three months[5]. This is comparable to our findings in our unselected patient group, although in our study cognition was measured within 30 minutes to 1 hour after ED arrival, while in the Canadian study cognition was assessed in the ED in 40% of the patients and within 7 days by telephone in approximately 60% of the patients. In another small study (n=188), patients with impaired cognition were admitted to a nursing home more often after hospitalisation, which is similar to our results. Finally, several studies investigated the association between cognitive impairment and other endpoints, like falls, hospital visits[14] and quality of life[6], and are therefore difficult to compare with the results of our study. Taken together, our study is the first to show the association of cognitive impairment with functional decline or mortality in unselected older ED patients.

We a priori hypothesized that cognitive impairment indicates increased vulnerability of the patients' brain that should be recognized because of the large implications. Our study shows that cognitive impairment *per se* is associated with functional decline or mortality when measured within one hour of ED arrival, irrespective of its cause, i.e. delirium, dementia, depression or hypoperfusion of the brain. Further, those with impaired cognition (e.g. dementia) and patients with hypoperfusion of the brain due to clinical illness are at increased risk of developing delirium. Finally, patients with pre-existing dementia can have superimposed delirium. Recognition of cognitive impairment *per se* may therefore prevent delirium. Unfortunately, ED physicians frequently miss the presence of impaired cognition[4, 15-17], probably due to a lack of education, adequate screening tools and recognition of patterns associated with a diagnosis of impaired cognition. We showed in our study that the 6-CIT is associated with functional decline and mortality and may therefore be a sensible screening tool.

Besides the higher probability of delirium, cognitive impairment has other implications for ED management of older patients which may help in preventing the associated adverse outcomes. For example, cognitive impairment complicates understanding of discharge instructions and may result in worse outcomes. Written discharge instruc-

tion is therefore especially important in cognitive impaired older patients. In addition, older patients often have impairments in multiple geriatric domains, such as the social network and mobility issues. Cognitive impairment may further increase the risk of adverse events and calls for interventions.

In a recent essay by Jackson *et al.*[3] there is a strong call for treating older patients with cognitive impairment on a 'need of care' basis, rather than on the basis of a diagnosis. There is a need for joined up care between professionals to improve detection, diagnostics and management, whatever the specific underlying diagnosis. In this light, the current study emphasizes the importance of screening for cognitive impairment, shortly after arrival to the ED, because impaired cognition is associated with functional decline or mortality, irrespective of disease severity, comorbidities and geriatric factors. Currently, proper multi-domain screening tools for older ED patients are lacking[18] and when designing these, cognitive function, for example as measured by the 6-CIT should be taken into account.

This study has several limitations. First, cognition was tested within thirty minutes to one hour after arrival to the ED. This could have influenced the cognition score. A patient who is anxious or in pain may perform worse resulting in an overestimation of impaired cognition. Second, we did not perform a delirium screening test. We therefore have no information on whether impaired cognition was of 'acute onset' or not. However, we set out to study the association of cognitive impairment irrespective of the cause. A third limitation is the fact that 'known dementia' was a self-reported measurement and not confirmed by medical charts or by the general practitioner. Finally, we did not perform a cognition test at follow up, so we do not know whether the impaired cognition had persisted for several months, or was a temporary problem. However, these limitations did not influence the validity of the study.

The strengths of this study are the broad, unselected inclusion and the high inclusion rate. Another strength is the multicentre, prospective study design with a relatively large number of patients giving us the opportunity to draw conclusions about a broad patient group that made our results more generalisable. Third, the outcome measure is clinically relevant and collected with a low chance of bias. Mortality was checked with the municipality records and the Katz-ADL is a well-validated measure. Finally, this is the first large, multicentre study focussing on cognitive impairment and composite adverse outcome (functional decline and mortality) in unselected older ED patients.

To conclude, cognitive impairment is highly prevalent in older ED patients and is associated with functional decline or mortality, independent of the cause of cognitive impairment, baseline functional status, disease severity and comorbidities.

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