Rehabilitation after Resuscitation

Wal, L.W. van der

Chapter 3

Cognitive problems in patients in a cardiac rehabilitation program after an out-of-hospital cardiac Arrest

Liesbeth W. Boyce – van der Wal
Gerard Volker
Thea P. M. Vliet Vlieland
Dominique M. J. van den Heuvel
Henk J. van Exel
Paulien H. Goossens

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Abstract

Objective
Estimate prevalence of cognitive problems due to hypoxic brain injury in out-of-hospital cardiac arrest (OHCA) survivors referred for cardiac rehabilitation and association with quality of life as well as autonomy and participation.

Design
Prospective cohort study.

Method
Consecutive OHCA patients. The Mini-Mental State Examination (MMSE), Cognitive Failures Questionnaire (CFQ) and Informant Questionnaire on Cognitive Decline in the Elderly (IQCODE) were administered 4 weeks after the OHCA. Cognitive problems were defined if MMSE <28, CFQ >32 or IQCODE >3.6. The Impact on Participation and Autonomy Questionnaire (IPAQ) (participation/ autonomy), the SF-36 Health Survey (SF-36) (quality of life) and the Hospital Anxiety Depression Scale (HADS) (anxiety/depression) were administered. Correlations between cognitive problems and participation/autonomy and quality of life were calculated.

Results
63 of 77 patients were male (82%), median age 59 years (range 15–84). MMSE median 29 (interquartile range 28–30), CFQ mean 20.9 (SD 9.4) and IQCODE mean 3.1 (SD 0.2). Eighteen patients (23%) scored positive for cognitive problems. Significant correlations were found between MMSE and IPAQ: autonomy inside ($r=-0.38$), family role ($r=-0.26$), autonomy outside ($r=-0.32$), social relations ($r=-0.38$) and social functioning ($r=0.32$). MMSE was related to SF-36: social functioning ($r=0.32$). The CFQ was related to IPAQ: autonomy outdoors ($r=0.29$) and SF-36: bodily pain ($r=-0.37$), vitality ($r=-0.25$), mental health ($r=-0.35$) and role emotional ($r=-0.40$). The IQCODE was related to IPAQ: autonomy indoors ($r=0.26$) and to SF-36: vitality ($r=-0.33$) and social functioning ($r=-0.41$).

Conclusion
Twenty-three percent of the patients referred for cardiac rehabilitation showed cognitive problems. Associations were found between cognitive problems and several aspects of participation/autonomy and perceived quality of life.

Introduction

In Europe, out-of-hospital cardiac arrest (OHCA) has an incidence of 86.4 per 100,000 inhabitants with a survival rate of 9% until hospital discharge.[1] In the Netherlands, survival is ranging from 16 to 22% for OHCA with a cardiac cause to 43% of emergency department attended OHCA.[2,3,4]

OHCA survival can be complicated by hypoxic brain injury with subsequent cognitive impairments. A systematic review in 2009 by Moulaert et al. on cognitive impairments in survivors after OHCA retrieved 28 studies. The authors of this review concluded, based upon three large, methodologically sound, prospective studies, that cognitive problems occurred in 42% to 50% of the ventricular fibrillation OHCA survivors.[5] Cognition was measured with a broad range of extensive neuropsychological tests. Memory, attention and executive functions were most affected.

Cognitive problems can be distinguished between cognitive impairments measured with objective cognitive tests and cognitive complaints assessed with subjective questionnaires. These objective and subjective cognitive problems cause a negative effect on participation/autonomy and quality of life.[6,7] A study by Stub et al. in 2011 of patients with OHCA of suspected cardiac cause in Australia showed that of the 31% of survivors 4% was referred to a nursing home, 18% went to a rehabilitation centre and 76% went directly home.[8] Based on the 42–50% of cognitive problems found in literature a substantial amount of patients have to cope with cognitive problems at home. According to Dutch guidelines all survivors who return home are qualified for cardiac rehabilitation.[9] Currently in cardiac rehabilitation, no attention is paid to potential (mild) cognitive problems. This is a problem, since (mild) cognitive problems can have a high impact on a person's participation/autonomy and quality of life.[10] Besides for patients with brain injury treatment (cognitive rehabilitation) is proven effective.[11]

To screen for cognitive problems, the Cerebral Performance Category could be used.[12] Unfortunately, this test is not sensitive in detecting mild cognitive problems.[13] Extensive neuropsychological testing can trace mild cognitive problems, but take approximately 3 h and thus not suitable as screening.[14–16]

As screening, the widely used and validated Mini-Mental State Examination (MMSE) is often used as gold standard to detect cognitive

impairment.[17] Unfortunately the MMSE is not standardised for patients after OHCA and one can question its sensitivity. In heart failure patients the MMSE showed a sensitivity/specificity of 0.70/0.66.[18,19] It seems necessary to complement the MMSE to increase the sensitiveness. In order to list cognitive complaints, a self-perceived neuropsychological functioning questionnaire was added, the Cognitive Failures Questionnaire (CFQ).[20] Considering that some patients have an impaired awareness of illness the validated Informant Questionnaire on Cognitive Decline of the Elderly (IQCODE), was used in which partners were asked to compare the patients cognition before and after the OHCA.[21]
With the results of three tests, the cognitive impairment (MMSE) and cognitive complaints (CFQ and IQCODE), patients were advised to follow a cardiac rehabilitation program or a cardiac rehabilitation supplemented with cognitive rehabilitation. All patients who showed a deviant score on one or more parts of the screening were advised to have an intake for cognitive rehabilitation. This study describes cognitive problems in patients referred for cardiac rehabilitation after OHCA using three concise tests. In addition, the association between the presence of cognitive problems and quality of life and autonomy and participation was studied.

Methods

Study design
This study had a prospective design. Data gathered for the present study were routinely recorded in clinical care, the Medical Ethical Review Board of the Leiden University Medical Center, Leiden, The Netherlands judged this study to be outside the remit of the Dutch Medical Research Involving Human Beings Act and provided a certificate of no objection.

Patients and setting
All consecutive OHCA survivors referred for cardiac rehabilitation to the Rijnlands Rehabilitation Centre in Leiden the Netherlands were eligible for this study. Based on an estimated inclusion rate of 3 patients per month and an arbitrary wish to include 75 patients, we decided to follow all patients between 1 February 2011 and 1 February 2013. The period was extended with 3 months to reach 75 patients. OHCA patients are referred to cardiac rehabilitation by their cardiologist and admitted within 2 weeks after discharge from the hospital. Institutionalised

patients were excluded from this research.
Socio-demographic characteristics and data on the cardiac arrest were retrieved from the medical record of the rehabilitation centre.
Questionnaires on cognitive functioning, quality of life and participation/autonomy were administered to the patients and their partners within 4 weeks after the cardiac arrest by a specialised nurse at the beginning of the cardiac rehabilitation.

Assessments
Patient and OHCA characteristics included gender, date of cardiac arrest, age at time of cardiac arrest and recorded cause of cardiac arrest: myocardial infarction, cardiac arrhythmia, cardiac myopathy, myocarditis and other (i.e. heart failure, electrocution, drowning). Eligible patients were seen by specialised nurses, who helped filling in questionnaires if needed. The whole assessment for patients took approximately 55 min; for partners 10–15 min.

Cognitive functioning
Cognition was evaluated using the MMSE, CFQ and IQCODE. The MMSE is an 11-item cognitive scale ranging from 0 to 30 points and takes 10 min to conduct. The test assesses multiple domains of cognitive functioning. A cut-off score of <28 was used to determine cognitive impairments.
The CFQ is a 25-item questionnaire for self-perceived cognitive functioning and takes 10 min to complete. The CFQ provides ratings of the perception on the frequency of various cognitive slips in daily life. Items are related to memory and attention. Ponds added four questions to identify an increase of possible cognitive mistakes and how these mistakes are troublesome, aggravating or worrying someone.[22] The scale ranges from 0 to 100 and a higher score indicates worse cognitive functioning. To assess problems in self-perceived cognitive functioning we used a score of >32 as cut-off.
The partner was asked to complete the Dutch version of the short IQCODE. This version consists of 16 items, aiming at cognitive functions like everyday memory and instrumental activities of daily living and takes 10–15 min to administer.[23] The questionnaire compares the present functioning with some point in the past (situation prior to the cardiac arrest). The questionnaire has been validated for the Dutch population.[24,25] There are five response alternatives from 1, much better to 5, much worse. Higher scores indicate a greater decline: we

used the cut-off point of >3.6.[26] Cognitive problems were defined as MMSE <28, CFQ >32 or IQCODE >3.6.
To get a first impression on the relevance of the cognitive tests used, relations to participation/autonomy and perceived quality of life in daily living were studied, using the Impact on Participation and Autonomy Questionnaire (IPAQ) and the Short Form-36 Health Survey (SF-36).[27,28,29] Since depression and anxiety are confounders for cognitive complaints and quality of life, the self-report screening Hospital Anxiety Depression Scale (HADS) was obtained.[30]

Participation and autonomy
To assess social participation and autonomy, the Dutch 'Impact on Participation and Autonomy Questionnaire' (IPAQ) was used. The IPAQ focuses on autonomy and participation of people with chronic conditions. It is developed to assess disease severity, needs and outcome. Per subcategory scores range from 0 to 4. A score of 0 is normal and higher scores indicate greater hindrance in participation and autonomy or an increased problem experience. The IPAQ takes approximately 20 min to administer.

Health related quality of life
To measure the generic health status, the Dutch version of the SF-36 Health Survey was used. The SF-36 is composed of 36 questions and organised into eight scales: physical functioning (PF), role limitations due to physical health problems (RP), bodily pain (BP), general health perceptions (GH), vitality (VT), social functioning (SF), role limitations due to emotional problems (RE), and general mental health (MH). All raw scale scores are linearly converted to a 0–100 scale, with higher scores indicating higher levels of functioning or well-being. The SF-36 takes 10 min to administer.

Anxiety and depression
Anxiety and depression were measured with the 14-item Hospital Anxiety Depression Scale (HADS) and takes <5 min to administer. The HADS consists of two 7-item scales, one for anxiety and one for depression. All items are rated on a 4-point scale (0–3). Patients with scores <8 on the 7-item scale are unlikely to have an anxiety disorder or a depression.[31] Our data shows a gap as result of changing the assessment of the cardiac rehabilitation decision support system. The HADS was suddenly left out. Due to this problem 26 patients were missed.

Analysis
Statistical analysis was performed using SPSS 22 software package. Descriptive statistics were used to present the demographic, medical and resuscitation characteristics. Mean (standard deviation) or median (range) scores and percentages of patients with cognitive problems according to fixed cut-off points of the instruments used were calculated. For the HADS the percentages of patients with possible anxiety or depressive problems were calculated using fixed cut-off points. Besides group differences were calculated on the severity of the scores of patients with cognitive problems vs. without cognitive problems using the Mann–Whitney U test.
For group differences of patients with and without cognitive problems in participation/autonomy and quality of life, as measured by IPAQ and SF-36, the Mann–Whitney U test was used. Spearman's Rho was calculated to study the relationships between baseline MMSE, CFQ and IQCODE scores and participation/autonomy (IPAQ) and quality of life (SF-36). p-Value <0.05 was used as statistically significant.

Results

Patients
Between February 2011 and May 2013, 77 patients fulfilled the inclusion criteria.
Table 1 shows the baseline socio-demographic characteristics of the patients. The majority (82%) were men, mean age 57.2 years (SD 13.8). Two-thirds of the participants (68%) lived together or were married. Of the patients 84% followed at least secondary level of education. The main cause of the OHCA was a myocardial infarction (81%). All the questionnaires filled in by patients and spouse were used in our study. Only one patient completed the questionnaires but decided afterwards to follow his cardiac rehabilitation elsewhere.

Table 1 Socio-demographic characteristics of OHCA survivors (n=77) admitted for cardiac rehabilitation

	n (%) or Mean (SD)
Age at time of cardiac arrest (range 15-84)	57.2 (13.8)
Gender	
Male	63 (82%)
Marital status*	
living together /married	52 (68%)
Education*	
primary school	6 (9%)
secondary school	33 (49%)
higher professional education	24 (35%)
Other	5 (7%)
Cause cardiac arrest	
myocardial infarction	62 (81%)
cardiac arrhythmia	5 (6%)
other	10 (13%)

SD - standard deviation
* n=68

Table 2 shows the cognitive functioning, anxiety, depression, participation/autonomy and quality of life of the participants. The median MMSE score was 29 (range 20–30) The mean score on the CFQ was 20.9 (SD 49) and on the IQCODE 3.1 (SD 0.2).

Table 2 Cognitive functioning, emotional problems, participation and quality of life of the participants

Domain	n	Cut-off	n (%) or mean (SD) or median (IQR)[#]
Age at time of CA	77		57.2 (13.8)
Gender	77		
Male			63 (82%)
Cognitive impairments			
MMSE	71	<28	29 (28-30)[#]
Cognitive functioning (self-perceived)			
CFQ	77	>32	20 (15-26)[#]
Cognitive functioning (informant)			
IQCODE	68	>3.6	3.0 (3.0-3.2)[#]
Emotional problems			
HADS Total	51	≥16	8.0 (5.7)
Depression	51	≥ 8	2 (1-4)[#]
Fear	51	≥ 8	5.1 (3.4)
Participation and Autonomy			
IPAQ			
autonomy indoors	76	---	0.8 (0.6)
family role	77	---	1.3 (0.8)
autonomy outdoors	77	---	1.3 (0.7)
social life/ relationships	77	---	1.0 (0.4)
work and education	51	---	1.6 (0.9)
Quality of Life			
Short Form-36			
physical functioning	77	---	70.7 (23.1)
role physical	77	---	30.7 (31.5)
bodily pain	77	---	69.2 (25.0)
general health	77	---	62.3 (18.1)
vitality	77	---	63.6 (20.4)
social functioning	76	---	70.4 (25.3)
role emotional	77	---	81.4 (33.5)
mental health	77	---	77.5 (17.2)

SD standard deviation; IQR Inter Quartile Range

CA Cardiac Arrest; MMSE Mini-Mental: State Examination; CFQ Cognitive Failures Questionnaire; IQCODE Informant Questionnaire on Cognitive Decline in the Elderly; HADS Hospital Anxiety and Depression Score; IPAQ Impact on Participation and Autonomy Questionnaire

Table 3 shows the scores below the cut-offs: 18 patients (25%) on the MMSE, 10 patients (13%) on the CFQ and 4 patients (6%) on the IQCODE. In total 18 patients (23%) showed cognitive problems with relatively little overlap between instruments (Fig 1.) Patients with cognitive problems did not significantly differ from patients without any cognitive problems in age (p=0.515), gender (p=0.057) or anxiety (p=0.063).

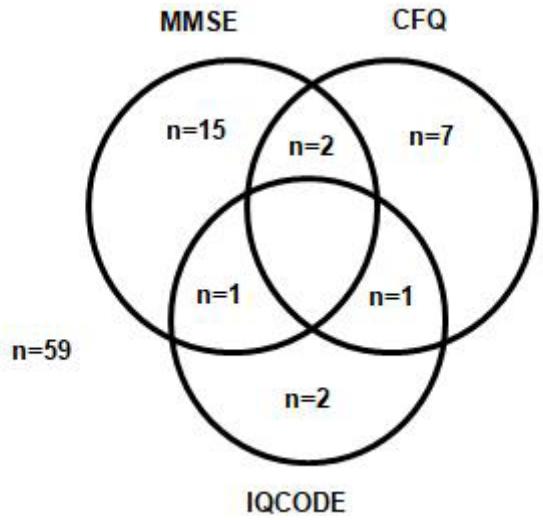

Fig. 1 Venn diagram of distribution OHCA patients who scored positive on Mini-Mental State Examination (MMSE)≥28, Cognitive Failures Questionnaire (CFQ) ≤32 or Informant Questionnaire on Cognitive decline in the Elderly (IQCODE) ≤3.6

Between patients with and without cognitive problems no significant differences were found in percentage of patients scoring positive for: fear 31% resp. 26% (p = 0.734) or depression 15% resp. 8% (p = 0.591). However on the severity of the domain depression of the HADS a significant difference was found between the patients with cognitive problems vs. the patients without cognitive problems (p = 0.025). Patients with cognitive complaints (Table 3) score worse on practically all domains of both IPAQ and SF-36.

Table 3 Group differences cognitive problems vs. no cognitive problems: Cognitive functioning, emotional problems, participation and quality of life of the participants

Domain		All patient		Cognitive problems		No cognitive problems	p-value*
	n	n (%) or mean (SD)	n	n (%) or mean (SD)	n	n (%) or mean (SD)	
Age at time of CA	77	57.2 (13.8)	18	59.6 (9.8)	59	56.5 (14.8)	.515
Gender	77		18		59		
Male		63 (82%)		12 (67%)		51 (86%)	.057
Cognitive functioning							
MMSE	71	28.8 (1.6)	18	27.3 (2.6)	53	29.2 (0.7)	.002
CFQ	77	20.9 (9.4)	20	29.1(11.2)	57	18.4 (7.2)	.001
IQCODE	68	3.1 (0.2)	16	3.3 (0.4)	52	3.1 (0.1)	.119
Emotional problems							
HADS Total	51	8.0 (5.7)	13	10.9 (4.2)	38	7.1 (5.9)	.018
Depression	51		13	4.5 (3.2)	38	2.4 (2.8)	.025
Fear	51		13	6.4 (1.9)	38	4.7 (3.7)	.063
Participation and Autonomy							
IPAQ							
autonomy indoors	76	0.8 (0.6)	17	1.2 (0.8)	59	0.8 (0.5)	.022
family role	77	1.3 (0.8)	18	1.8 (1.2)	59	1.1 (0.6)	.010
autonomy outdoors	77	1.3 (0.7)	18	1.7 (0.9)	59	1.1 (0.6)	.004
social life/ relationships	77	1.0 (0.4)	18	1.1 (0.5)	59	0.9 (0.4)	.145
work and education	51	1.6 (0.9)	10	1.8 (1.0)	41	1.6 (0.8)	.320
Quality of Life							
Short Form-36							
physical functioning	77	70.7 (23.1)	20	58.4 (27.5)	57	74.4 (20.4)	.034
role physical	77	30.7 (31.5)	20	15.3 (15.2)	57	35.5 (33.7)	.035
bodily pain	77	69.2 (25.0)	20	59.4 (25.1)	57	72.2 (24.4)	.064
general health	77	62.3 (18.1)	20	56.8 (15.2)	57	64.0 (18.6)	.225
vitality	77	63.6 (20.4)	20	54.4 (23.5)	57	66.4 (18.7)	.037
social functioning	76	70.4 (25.3)	19	54.4 (25.4)	57	75.0 (23.6)	.003
role emotional	77	81.4 (33.5)	20	66.7 (39.6)	57	85.9 (30.5)	.004
mental health	77	77.5 (17.2)	20	68.2 (15.6)	57	80.3 (16.7)	.018

CA Cardiac Arrest; MMSE Mini-Mental: State Examination; CFQ Cognitive Failures Questionnaire; IQCODE Informant Questionnaire on Cognitive Decline in the Elderly; HADS: Hospital Anxiety and Depression Score; IPAQ: Impact on Participation and Autonomy Questionnaire

Table 4 shows that the MMSE relates to the IPAQ categories autonomy inside (r = −0.375), family role (r = −0.256), autonomy outside (r = −0.318) and social relations (r = −0.381). The CFQ related best to the IPAQ autonomy outside (r = 0.287). The IQCODE showed a relation with the IPAQ autonomy inside (r = 0.260).
The significant relation between the MMSE and the SF-36 was visible in social functioning (r = 0.317). The CFQ showed a significant relation with the SF-36 in bodily pain (r = −0.366), vitality (r = −0.250), mental health (r = −0.351) and role emotional (r = −0.400). The IQCODE was significantly related to the SF-36 in vitality (r = −0.332) and social functioning (r = −0.412). The HADS subscales depression and fear show no significant relation with MMSE (resp. r = 0.52 and 0.82), CFQ (resp. r = 0.15 and 0.06) or IQCODE (resp. r = 0.36 and 0.62).

Table 4 Spearman Correlations of total group (N=77) on cognitive functioning vs. participation, quality of life and depression.

	MMSE		**CFQ**		**IQCODE**	
	r_s	p-value	r_s	p-value	r_s	p-value
IPAQ						
autonomy indoors	-.38	.001	.20	.091	.26	.032
role family	-.26	.031	.16	.153	.12	.330
autonomy outdoors	-.32	.007	.29	.011	.14	.271
social relations	-.38	.001	.16	.176	.10	.433
work and education	-.20	.168	.17	.228	.25	.093
SF-36						
physical	.17	.161	-.16	.176	-.24	.051
bodily pain	.03	.818	-.37	.001	-.13	.277
role physical	.20	.091	-.05	.650	-.10	.443
general health	.15	.214	-.12	.313	-.07	.578
vitality	.13	.266	-.25	.028	-.33	.006
social functioning	.32	.007	-.17	.139	-.41	.001
mental health	.15	.200	-.35	.002	-.19	.115
role emotional	-.10	.414	-.40	.000	-.11	.377
HADS						
depression	.10	.522	.21	.147	.14	.364
fear	-.03	.819	.27	.055	.08	.620

MMSE Mini-Mental State Examination; CFQ Cognitive failures questionnaire; IQCODE Informant Questionnaire on Cognitive Decline in the Elderly; IPAQ Impact Profile on Autonomy Questionnaire

Discussion

This study shows that cognitive problems occur in 23% of patients referred for cardiac rehabilitation. A correlation between cognition and participation/autonomy and quality of life was found in the categories autonomy in- and outside, family role, social relations/ social functioning, bodily pain, vitality, mental health and emotional.
The 23% cognitive problems in OHCA survivors found in this study is lower than found in literature (42–50%). Maybe not all patients are actually referred for rehabilitation or the sensitivity of the tests used is insufficient. In the Leiden region, 80% of the OHCA survivors living in the affiliated area of the rehabilitation centre are referred for cardiac rehabilitation. The 20% non-referrals went to nursing homes or had comorbidity preventing participation in rehabilitation (unpublished data). These patients might have higher chances of cognitive impairments.
The mean MMSE score found in this study 28.8 (SD 1.6) is similar as found in a study of Mateen in survivors 6 months after the cardiac arrest due to ventricular fibrillation (28.6). Besides the objective MMSE, commonly used as gold standard, the subjective CFQ and the IQCODE were used to assess cognitive functioning. The CFQ retrieved 7 patients with cognitive complaints that were not found with the MMSE and the IQCODE identified an additional 2 patients.

In this study, the CFQ retrieves more and for 70% other patients than the MMSE. It is important though to take the influence of concernedness or depression into account since these factors may lead to higher scores on the CFQ, therefore the HADS was administered. Between patients with and without cognitive problems no significant differences were found in percentage of patients scoring positive for: fear 31% resp. 26% ($p = 0.734$) or depression 15% resp. 8% ($p = 0.591$). However on the severity of the domain depression of the HADS a significant difference was found between the patients with cognitive problems vs. the patients without cognitive problems ($p = 0.025$).

The contribution of the IQCODE seems limited. This might be caused by the early moment that informants are questioned. Patients only recently had an OHCA and are only just dismissed from hospital at time of the screening. Cognitive impairments might not yet be visible to the

partner. Besides, one could hypothesise that euphoria, that patient is still alive, might influence outcomes. Further research on the use of the IQCODE is therefore necessary.

In this study, the association of the used cognitive test and questionnaires and the experienced participation/autonomy and quality of life was obtained. Correlations were only moderate to weak. This can be explained by the fact that participation/autonomy and quality of life are likely to be influenced by limitations in cognitive functioning, there are many other potential factors which may have an impact. Patients who scored below the MMSE cut-off point experienced more participation/autonomy problems (IPAQ) on all domains except on work. This seems plausible since patients are not working at the moment of the questionnaire. For patients that scored low on the MMSE (<28), social functioning was mainly affected with regard to quality of life (SF-36).

The subjective CFQ and IQCODE show a relation with participation/ autonomy on respectively autonomy outdoors and indoors and correlate with multiple dimensions of quality of life. Although correlations with the different domains are weak to moderate it does indicate possible coping problems. By taking objective cognitive impairments and subjective cognitive complaints into account a combination of the MMSE, CFQ and IQCODE seems a first step towards a short (approximately 20 min) cognitive screening after an OHCA.
For patients showing cognitive problems on any of these tests, the administration of more extensive neuropsychological tests is warranted in order to provide a tailored cognitive rehabilitation program. Moulaert at al. also found that an early intervention program which pays attention towards cognitive problems after OHCA is very welcome by patients and spouse.

We chose to administer the questionnaires 4 weeks after the OHCA since this is the start point of the rehabilitation program. Probably, this moment does not reflect the end-point situation and cognitive improvement might occur during the rehabilitation period.

Our data being gathered as part of a cardiac rehabilitation program also causes another drawback of this study because only a limited amount of medical data and data concerning the OHCA in this specific

population is available. More extensive data on the characteristics of the OHCA of this population are described in previous research of Boyce, that described survival of OHCA patients transferred to emergency unit in the region Leiden. (73% male, median age 65 years, 76% of cardiac origin and 5% shockable rhythm, 74% witnessed, 76% bystander cardiopulmonary resuscitation and 39% automatic external defibrillator.)

Another limitation is the cognitive and behavioural status of patients prior to the OHCA. Although partners are asked to fill in the IQCODE and compare it with the situation prior to the OHCA this is a subjective point of view. Due to the unexpected nature of OHCA most of the time no objective data before the CA is available. Another drawback is the lack of a gold standard as screening to identify (mild) cognitive problems. Based on poor outcomes on one of the three cognitive measures, participants are assigned to either one of the two groups: with or without cognitive problems. The evidence for making such group distinction will remain open but is a first step forward towards a screening for cognitive problems of patients after OHCA. In future a decent comparison should be made between the screening and extensive neuropsychological tests serving as the gold standard for patients after OHCA.

Conclusion

This study describes the use of a simple cognitive assessment in patients referred for cardiac rehabilitation after OHCA. Using the MMSE 10% has cognitive impairments, using the CFQ 13% has cognitive complaints. Using the combination of MMSE, CFQ and IQCODE 23% of cardiac rehabilitation referred patients after OHCA experience cognitive problems. The MMSE and the CFQ seem to be rather complementary. This study shows that patients with cognitive problems due to OHCA experience lower levels of participation/autonomy and decreased quality of life (SF-36).

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