Factors predicting quality of life and societal participation after survival of a cardiac arrest

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Clinical paper

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ABSTRACT

Aim: For those patients who suffer unfavourable outcome after survival of cardiac arrest, it is important to know whether this can be predicted at an early stage. Support can subsequently be provided. This study aimed to identify early prognostic factors of quality of life (QOL) and societal participation at one year post-cardiac arrest.

Methods: The design was a prospective longitudinal cohort study following cardiac arrest survivors up to one year. Prognostic personal, injury-related, function-related and subjective outcome factors were selected and entered into a hierarchical regression model to assess whether they were predictive of QOL and societal participation at one year post-cardiac arrest.

Results: Hundred and ten cardiac arrest survivors were included. Not having a partner, more functional limitations (at two weeks) and cognitive complaints were significantly predictive of lower physical QOL, while higher levels of anxiety and depression symptoms (at three months) were significant predictors of mental QOL. A neurological history and higher levels of anxiety and depression symptoms were significantly predictive of lower brain injury-specific QOL. Societal participation was only predicted by pre-morbid functioning.

Conclusion: This study identified prognostic factors of QOL and societal participation one year after survival of cardiac arrest. Screening of these factors in early stages can identify those survivors with possibly unfavourable QOL at one year post cardiac arrest. For those survivors, preventive and targeted interventions may be offered.

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Introduction

Surviving a cardiac arrest is not always without consequences, especially for those suffering a hypoxic brain damage. It was recently shown that most patients return to pre-arrest levels of functioning in terms of participation (for instance return to work) and quality of life (QOL) [1,2]. However, a minority of the survivors

cannot return to their life as before and for those it is important to know whether this unfavourable outcome can be predicted at an early stage in order to support people.

In a retrospective cohort study, we showed that age and gender were significantly related to societal participation and QOL three years after the cardiac arrest [3]. Physical QOL was significantly related to cognitive complaints, daily activities, post-traumatic stress and fatigue, while mental QOL was explained by emotional problems, cognitive complaints and fatigue [4]. Apparently both personal factors and subjective outcome influence long term outcome.

Prognostic studies on long term participation and QOL after cardiac arrest are however scarce. In a prospective cohort study

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on moderate to severe traumatic brain injury (TBI), emotional problems next to length of stay, have shown to be independent predictors of long term mental QOL, while physical QOL was explained by time since injury, length of stay and functional outcome [5]. From a TBI perspective, this means that injury-related factors are also important. Forslund et al. [6] additionally showed that better community integration and a positive change in physical QOL over time predicted better physical QOL at two years post TBI. Lower depression scores and positive change in mental QOL over time predicted higher mental QOL scores at two years. In a prospective cohort study on mild stroke patients [7], stable low QOL and a decline in QOL over time were predicted by psychological factors such as less acceptance, self-efficacy, and proactive coping and more neuroticism, pessimism, helplessness, and passive coping.

From these retrospective studies on cardiac arrest and prospective studies on other forms of brain injury it can be concluded that a prediction model for long term societal participation and QOL should incorporate many different prognostic factors related to the person, the injury and the short-term outcome. The aim of the current study was therefore to investigate which factors predict long term outcome in terms of societal participation and QOL after survival of a cardiac arrest. We considered personal (premorbid) factors, injury-related factors, early function-related factors and subjective outcome at three months post cardiac arrest as independent predictors of outcome (QOL and societal participation) at one year.

Methods

Design

The current study stems from the project called 'Activity and Life After Survival of a Cardiac Arrest' (ALASCA) [ISRCTN74835019] [8] which was a prospective longitudinal cohort study with a nested randomised controlled trial ($n=238$). The current study excluded patients who were allocated to the intervention group ($n=97$) and therefore the current cohort consists of 141 patients ($238 - 97 = 141$) who only received the usual care. Their situation seems most reflective for a 'natural' course and is in comparison with the design of the study of Moulaert et al. [1].

Participants

Recruitment of patients took place between April 2007 and December 2010 at coronary care- and intensive care units of seven hospitals in the Netherlands. The hospitals had protocols for the care of resuscitation patients in accordance with international guidelines, thereby providing hypothermia and pacemaker implementation [9].

Inclusion criteria were survival more than two weeks after an in- or out-of-hospital cardiac arrest, living within 50 km of one of the participating hospitals, age ≥ 18 and sufficient command of the Dutch language. Excluded were patients who had a life expectancy of less than three months due to another medical condition, as estimated by their treating physician.

Procedure

Newly admitted patients who survived a cardiac arrest were assessed for eligibility and when eligible, approached for participation in this study three to ten days post cardiac arrest. Informed consent was subsequently obtained. Caregivers were asked to give provisional consent when patients were not capable of giving consent at that point. Patients were again approached when they had the capacity to decide and could be assessed. After informed consent was obtained, medical and socio-demographic information

was collected from medical records. Baseline measurements took place at two weeks post-cardiac arrest which had a follow-up at three and twelve months. Measurements took place at the patients' home, conducted by research assistants. All participating hospitals followed the same procedure.

This study complies with the Declaration of Helsinki and has been approved by the Medical Ethics Committee of Maastricht University Medical Centre, and all participating hospitals.

Measures

Outcome variables

Quality of life. The Medical Outcomes Study 36-item Short Form Health Survey (SF-36/RAND-36 item Health Survey) is a generic QOL measure. A Physical Component Score (PCS) and the Mental Component Score (MCS) can be calculated with the use of the original manual [10]. Higher scores are indicative of higher self-reported physical/mental functioning.

The Quality Of Life after Brain Injury (QOLIBRI) questionnaire consists of 37 items (0–100 scale) where higher scores are indicative of higher brain injury-specific QOL [11].

Societal participation. The Community Integration Questionnaire (CIQ) consists of 15 items where higher scores indicate a higher level of societal participation [12].

Predictor variables

Personal factors. The following factors were retrieved from medical files and/or at initial assessment: age at cardiac arrest, gender, if the patient had a partner and a cardiac and neurological history.

The Frenchay Activities Index (FAI) consists of 15 items where higher scores are indicative of a higher level of extended activities of daily living (ADL) [13].

Characteristics of the cardiac arrest. Whether the patient suffered an in- or out of hospital cardiac arrest, time collapse to return of spontaneous circulation (ROSC; minutes) and possible coma (in days), and whether or not an implantable cardioverter defibrillator (ICD) had been implemented were retrieved from medical files and/or collected at the initial assessment.

Function-related variables. Cardiac pump function after the cardiac arrest is indicated by the left-ventricular ejection fraction (LVEF), which was retrieved from the medical files at the initial assessment.

The New York Heart Association Classification (NYHA) is a functional measurement and classification system of cardiovascular disability. A higher score is indicative of more functional limitations [14].

The Barthel Index (BI) consists of 10 items (range 0–20) where higher scores are indicative of a higher level of independence in basic ADL [15].

The Cognitive Log (CogLog) is a 10 item cognitive screening instrument (0–30 range). Higher scores indicate better cognitive functioning [16].

Subjective outcome. The Cognitive Failures Questionnaire (CFQ) consists of 25 items (0–100 scale) where higher scores indicate that the patient has more cognitive complaints [17].

The Hospital Anxiety and Depression Scale (HADS) consists of 14 items (range 0–21) where higher scores represent more experienced problems, for either the subscale Anxiety or Depression [18].

The Impact of Event Scale (IES) consists of 15 items (0–75 range) in which higher scores are indicative of a higher level of posttraumatic stress [19,20].

Fig. 1. Flow of participants through the study.

The Fatigue Severity Scale (FSS) consists of nine self-report items (range 0–7) where higher scores are indicative of more severe fatigue symptoms [21].

Analyses

Baseline characteristics of patients who still participated in this study at 12 months post-cardiac arrest are described. Differences in baseline characteristics between included patients and drop-outs were examined using independent sample *t*-tests (normal distributed), Mann-Whitney U (non-normal distributed), Fisher's Exact tests or Pearson chi-square tests. Thereby checking for potential selection bias. Normal distribution of data was checked with the use of visual inspection of histograms and the Kolmogorov-Smirnov test ($p \leq 0.001$). Missing data was not imputed. Subsequently, bivariate analyses using Pearson correlation coefficients were performed to find significant associations between predictor variables and outcome variables QOL and societal participation. If one variable was non-normally distributed, Spearman rank-order correlations were used.

Significantly associated predictors were entered in the hierarchical regression analyses. The following blocks were used (in sequence): 1) personal factors; 2) characteristics of the cardiac arrest; 3) function-related factors at two weeks post-cardiac arrest and 4) subjective outcome at three months post-cardiac arrest.

The assumptions of additivity and linearity, independent errors, homoscedasticity and normally distributed errors were checked. An alpha of 0.05 was set and SPSS version 22.0 was used for analyses.

Results

A total of 141 patients participated of which 110 (78%) still participated at 12 months post-cardiac arrest (Fig. 1). Table 1 displays characteristics of the included patients. Included patients showed significant higher cognitive functioning than drop-outs (CogLog score 26.6 vs. 23.9, $p=0.01$). Differences on other characteristics were non-significant.

With regard to the QOL at one year post-cardiac arrest, included patients showed a mean of 44.2 (SD=11.0) on the PCS; 50.6 (SD=10.7) on the MCS; and 72.9 (SD=16.8) on the QOLIBRI. A mean of 14.2 (SD=5.4) was shown on societal participation, i.e. the CIQ.

Physical QOL (PCS of the SF-36)

Bivariate analyses (Table 2) showed that three personal factors (neurological history ($p=0.02$), premorbid functioning ($p=0.01$) and having a partner ($p=0.008$)) correlated significantly with the PCS. Furthermore, three function-related factors (cardiac pump function ($p=0.007$), functional level ($p<0.001$) and ADL independency ($p=0.007$)) and all subjective outcomes (cognitive

Table 1
Patients' characteristics (n = 110).

	n total	n (%) or mean (SD) or median (range)
Socio-demographic variables		
Male	110	94 (85.5%)
Age (years)	110	59.7 (10.8)
Marital status	102	
- Married/partner		90 (88.2%)
- Single/divorced/widowed		12 (11.8%)
Highest level of education	103	
- Lower education		80 (77.7%)
- Higher education		23 (22.3%)
Living situation, pre-morbid	108	
- Living at home		
- Independent		97 (89.8%)
- With help from others		9 (8.3%)
- Nursing home/sheltered facility		2 (1.9%)
Daily functioning (FAI), pre-morbid	107	26.4 (7.6)
Societal participation (CIQ), pre-morbid	102	15.6 (4.6)
Employment status, pre-morbid	109	
- Full-time job		36 (33.0%)
- Part-time job		20 (18.3%)
- Not working		53 (48.6%)
Medical history		
Cardiovascular history, i.e one/more of:	105	66 (62.9%)
- Hypertension		32 (30.5%)
- Myocardial infarction		33 (31.4%)
- Heart failure		5 (4.8%)
- Cardiac arrest		2 (1.9%)
- CABG		8 (7.6%)
- Arrhythmia		7 (6.7%)
Diabetes mellitus	105	10 (9.5%)
Neurological history	105	12 (11.4%)
Characteristics of cardiac arrest		
In-hospital cardiac arrest	110	21 (19.1%)
Cardiac cause	102	90 (88.2%)
Initial cardiac rhythm VF/VT	94	87 (92.6%)
Witnessed cardiac arrest	108	102 (94.4%)
Direct start CPR	107	97 (90.7%)
Time collapse to ROSC, minutes	47	10.0 (0–60.1)
Medical interventions		
- Induced hypothermia	105	46 (43.8%)
- Catheterization with PCI	105	50 (47.6%)
- CABG	105	13 (12.4%)
- ICD	104	28 (26.9%)
Characteristics after cardiac arrest		
Duration coma, in days	84	1.0 (0–11)
Duration PTA, in days	74	3.0 (0–78)
LVEF at discharge, %	43	45.2 (10.8)
Activities of daily living (BI) at 2 weeks	96	20.0 (1–20)
NYHA at 2 weeks	98	2.0 (1–4)
Cognitive functioning (CogLog) at 2 weeks	99	27.0 (16–30)
Subjective outcome at three months		
Cognitive complaints (CFQ)	100	24.8 (15.3)
Anxiety (HADS)	106	3.0 (0–19)
Depression (HADS)	103	2.0 (0–18)
Post-traumatic stress (IES)	105	11.0 (0–62)
Fatigue (FSS)	104	4.2 (1.7)

Abbreviations: FAI, Frenchay Activities Index; CIQ, Community Integration Index; CABG, Cerebral Artery Bypass Grafting; VF, Ventricular Fibrillation; VT, Ventricular Tachycardia; CPR, Cardiopulmonary Resuscitation; ROSC, Return Of Spontaneous Circulation; PCI, Percutaneous Coronary Intervention; ICD, Implantable Cardioverter Defibrillator; PTA, Post Traumatic Amnesia; LVEF, Left Ventricular Ejection Fraction; BI, Barthel Index; NYHA, New York Heart Association Functional Classification; CogLog, the Cognitive Log; CFQ, Cognitive Failure Questionnaire; HADS, Hospital Anxiety Depression Scales; IES, Impact of Events Scale; FSS, Fatigue Severity Scale.

complaints ($p < 0.001$), anxiety ($p < 0.001$), depression ($p < 0.001$), post-traumatic stress ($p = 0.005$) and fatigue ($p < 0.001$) were significantly associated. No characteristics of the cardiac arrest showed significant correlations with PCS ($p > 0.05$). Cardiac pump function was not entered into the hierarchical regression because of a low response rate ($n = 43$).

Hierarchical regression analyses (Table 2) showed in the first step that personal factors explained 12.7% of the variance in the PCS. In the second step, function-related factors significantly explained an additional 27.8% ($p < 0.001$) and subjective outcome added 10.3% of explained variance in the third step ($p = 0.03$). The final model explained 50.8% of the variance, with not having a partner ($p = 0.01$), lower physical functioning at two weeks post-cardiac arrest ($p < 0.001$) and more cognitive complaints at three months post-cardiac arrest ($p = 0.03$) predicted lower physical QOL.

Mental QOL (MCS of the SF-36)

Bivariate analyses (Table 2) showed that one personal factor (neurological history ($p = 0.03$)) and one function-related measure at two weeks post-cardiac arrest (functional level ($p = 0.04$)) significantly correlated with the MCS. In addition, all five subjective outcome measures at three months post-cardiac (cognitive complaints ($p = 0.01$), anxiety ($p < 0.001$), depression ($p < 0.001$), post-traumatic stress ($p = 0.02$) and fatigue ($p = 0.03$)) were significantly associated. No characteristics of the cardiac arrest were associated ($p > 0.05$).

Hierarchical regression analyses (Table 2) showed in the first step that one personal factor (neurological history) explained 0.7% of the variance in the MCS, in the second step, one function-related factor explained an additional 5.1% ($p = 0.04$) and in the third step subjective outcome added 43.3% of explained variance ($p < 0.001$). The final model explained 49.2% of the variance, with more symptoms of anxiety ($p = 0.002$) and depression ($p = 0.003$) being significant predictors of a lower mental QOL.

QOLIBRI (Brain injury-specific QOL)

Bivariate analyses (Table 3) showed that two personal factors (neurological history ($p < 0.001$) and premorbid functioning ($p = 0.001$)) and three function-related factors (functional level ($p = 0.002$), cognitive functioning ($p = 0.02$) and ADL independency ($p < 0.001$)) were significantly correlated with the QOLIBRI. All five subjective outcome measures were significantly associated: cognitive complaints ($p < 0.001$), anxiety ($p < 0.001$), depression ($p < 0.001$), post-traumatic stress ($p = 0.001$) and fatigue ($p < 0.001$). No characteristics of the cardiac arrest were related to the QOLIBRI ($p > 0.05$).

Hierarchical regression analyses (Table 3) showed in the first step that personal factors explained 11.4% of the variance in the QOLIBRI. An additional 9.2% was explained in the second step, but this increase was non-significant ($p > 0.05$). Subjective outcome measures significantly added 40.9% of explained variance in the third step ($p < 0.001$). The final model explained 61.5% of the variance, with having a neurological history ($p = 0.01$), more symptoms of anxiety ($p = 0.002$) and depression ($p = 0.049$) being significant predictors of a lower QOL from a brain injury perspective.

CIQ (Level of societal participation)

Bivariate analyses (Table 3) showed that three personal factors (age ($p = 0.001$), neurological history ($p < 0.001$) and premorbid functioning ($p < 0.001$)) and three function-related factors (functional level ($p = 0.001$), cognitive functioning ($p = 0.01$) and ADL independency ($p = 0.02$)) were associated with the CIQ. In addition, two subjective outcome measures (depression ($p = 0.03$) and fatigue ($p = 0.045$)) were also associated. No characteristics of the cardiac arrest were related to the CIQ ($p > 0.05$).

Hierarchical regression analyses (Table 3) showed in the first step that personal factors explained 26.8% of the variance in the CIQ. An additional 5.0% was explained by the function-related factors in the second step, however being non-significant ($p > 0.05$).

Table 2

Predictors of physical and mental quality of life.

Predictors	SF-36 PCS				SF-36 MCS			
	Bivariate	Multivariate (beta)			Bivariate	Multivariate (beta)		
	Spearman's r	Step 1	Step 2	Step 3	Spearman's r	Step 1	Step 2	Step 3
Personal factors								
Age	-.176	NE	NE	NE	.186	NE	NE	NE
Gender (female/male)	-.086	NE	NE	NE	-.019	NE	NE	NE
Partner (no/yes)	.265 [*]	.266 [*]	.238 [*]	.219 [*]	.026	NE	NE	NE
Cardiac history (no/yes)	-.144	NE	NE	NE	.092	NE	NE	NE
Neurological history (no/yes)	-.233 [*]	-.048	.017	.095	-.214 [*]	-.083	-.054	-.121
Premorbid functioning (FAI)	.247 [*]	.234	.142	.133	.058	NE	NE	NE
Characteristics of the cardiac arrest								
In hospital (no/yes)	-.105	NE	NE	NE	.023	NE	NE	NE
Time collapse to ROSC ^a	-.218	NE	NE	NE	-.055	NE	NE	NE
Duration of coma (days) ^a	-.045	NE	NE	NE	.114	NE	NE	NE
ICD (no/yes)	-.118	NE	NE	NE	-.009	NE	NE	NE
Function-related factors at 2 weeks post-cardiac arrest								
Cardiac pump function (LVEF) ^a	.413 [*]	NE	NE	NE	.101	NE	NE	NE
Functional level (NYHA)	-.469 ^{**}	NE	-.507 ^{**}	-.415 ^{**}	-.210 [*]	NE	-.228 [*]	-.068
ADL independency (BI)	.259 [*]	NE	.063	.099	.118	NE	NE	NE
Cognitive functioning (CogLog)	.191	NE	NE	NE	.171	NE	NE	NE
Subjective outcome 3 months post-cardiac arrest								
Cognitive complaints (CFQ)	-.458 ^{**}	NE	NE	-.259 [*]	-.252 [*]	NE	NE	.029
Anxiety (HADS)	-.394 ^{**}	NE	NE	.081	-.492 ^{**}	NE	NE	-.456 [*]
Depression (HADS)	-.445 ^{**}	NE	NE	-.064	-.472 ^{**}	NE	NE	-.394 [*]
Post-traumatic stress (IES)	-.276 [*]	NE	NE	.110	-.234 [*]	NE	NE	.150
Fatigue (FSS)	-.526 ^{**}	NE	NE	-.177	-.213 [*]	NE	NE	.080
R ²		.127	.405	.508		.007	.058	.492
Adjusted R ²		.091	.363	.434		-.006	.034	.444
ΔF			16.6 ^{**}	2.8 [*]			4.3 [*]	12.6 ^{**}

Abbreviations: SF-36, Short Form-36; PCS, Physical Component Score; MCS, Mental Component Score; FAI, Frenchay Activities Index; ROSC, Return Of Spontaneous Circulation; ICD, Implantable Cardioverter Defibrillator; LVEF, Left Ventricular Ejection Fraction; NYHA, New York Heart Association Functional Classification; CogLog, the Cognitive Log; BI, Barthel Index; CFQ, Cognitive Failure Questionnaire; HADS, Hospital Anxiety Depression Scales; IES, Impact of Events Scale; FSS, Fatigue Severity Scale; NE, Not Entered.

^a Response rate less than 85%.

^{*} $p < 0.05$.

^{**} $p \leq 0.001$.

Subjective outcome measures added 1.6% of explained variance in the third step, however non-significantly ($p > 0.05$). The final model explained 33.4% of the variance, with lower premorbid functioning ($p = 0.002$) as significant predictor for less societal participation.

Discussion

In this prospective study, we examined the contribution of four groups of variables (personal factors, characteristics of cardiac arrest, early function-related factors and subjective outcome at three months) on QOL and societal participation one year after survival of a cardiac arrest. Concerning demographic information, we found that having a partner was a positive predictive personal factor on physical QOL and that neurological history had a negative impact on brain injury-specific QOL. Characteristics of the cardiac arrest did not have any significant impact. From the early function-related measures at two weeks only functional level contributed to physical QOL. The subjective outcome measures at three months had the strongest contribution to QOL with cognitive complaints, anxiety and depression as significant predictors. Societal participation was only predicted by premorbid daily functioning.

Previously, we performed a retrospective study in which determinants of QOL were also examined. Physical QOL was found to be related to cognitive complaints, daily activities, posttraumatic stress and fatigue, while mental QOL was related to anxiety and depression and cognitive complaints [4]. This earlier retrospective study differs in design from the current study: besides the retrospective design, several factors had not been introduced into the regression models (personal, cardiac arrest related and early function-related factors). Results of both studies showed interesting differences: although both fatigue and posttraumatic stress

showed significant bivariate correlations in both studies, they were no longer significant predictors in the final model in the current study. Furthermore, cardiac arrest-related factors did not predict QOL, which might have been expected from the brain injury literature [5].

Another interesting finding is that cognitive complaints (subjective) at three months did predict physical QOL, whereas objective cognitive impairments did not. It is earlier observed in cardiac-arrest survivors with hypoxic brain damage that cognitive complaints influence QOL [22]. Despite not observed here, earlier studies in cardiac arrest survivors [23] as well as brain injury populations [24–27] showed that cognitive impairment negatively influences QOL. As cognitive complaints indeed negatively affect QOL and complaints increase during the first year post-cardiac arrest [1], it should be encouraged to examine both of these factors during regular follow-up consults.

This study also confirmed the impact of emotional functioning on QOL, which was already shown in a study by Larsson et al. [28] which indicated that both anxiety and depression were negatively related to QOL. This association was earlier shown in other types of brain injury, such as stroke or traumatic brain injury [29,30].

This study has several strengths. This study distinguishes a broad scope of potential influencing factors for long-term functioning and QOL. The broad concept of QOL was additionally examined in differentiated constructs [31] by using measures with different operationalisations; as well as from a brain injury perspective. A limitation is that drop-outs had lower cognitive functioning scores, which could indicate a selection bias. Some of the predictors may be evidently associated because they are represented in the outcome measure as well, for instance anxiety and depression are associated with MCS and are as well part of this score. Furthermore, there

Table 3
Predictors of brain injury-specific quality of life and societal participation.

Predictors	QOLIBRI				CIQ			
	Bivariate	Multivariate (beta)			Bivariate	Multivariate (beta)		
		Step 1	Step 2	Step 3		Step 1	Step 2	Step 3
	Pearson's ρ or Spearman's r^b				Pearson's ρ or Spearman's r^b			
Personal factors								
Age	-.014	NE	NE	NE	-.334**	-.089	-.080	-.111
Gender (female/male)	.025	NE	NE	NE	.153	NE	NE	NE
Partner (no/yes)	.196	NE	NE	NE	-.175	NE	NE	NE
Cardiac history (no/yes)	.072	NE	NE	NE	-.048	NE	NE	NE
Neurological history (no/yes)	-.397**	-.244*	-.186	-.251*	-.357**	-.105	-.060	-.021
Premorbid functioning (FAI)	.327**	.160	.091	.042	.498**	.415**	.383*	.387*
Characteristics of the cardiac arrest								
In hospital (no/yes)	-.091	NE	NE	NE	-.135	NE	NE	NE
Time collapse to ROSC ^{a,b}	.047	NE	NE	NE	.117	NE	NE	NE
Duration of coma (days) ^{a,b}	.110	NE	NE	NE	-.063	NE	NE	NE
ICD (no/yes)	.108	NE	NE	NE	-.025	NE	NE	NE
Function-related 2 weeks post-cardiac arrest								
Cardiac pump function (LVEF) ^a	.184	NE	NE	NE	.024	NE	NE	NE
Functional level (NYHA)	-.331*	NE	-.238	-.154	-.353**	NE	-.208	-.157
ADL independency (BI)	.281**	NE	.090	.047	.244*	NE	-.007	-.029
Cognitive functioning (CogLog) ^b	.247*	NE	.067	.021	.260*	NE	.071	.088
Subjective measures at 3 months post-cardiac arrest								
Cognitive complaints (CFQ)	-.497**	NE	NE	-.150	-.104	NE	NE	NE
Anxiety (HADS) ^b	-.620**	NE	NE	-.419*	-.081	NE	NE	NE
Depression (HADS) ^b	-.574**	NE	NE	-.245*	-.220*	NE	NE	.010
Post-traumatic stress (IES) ^b	-.349**	NE	NE	.025	.016	NE	NE	NE
Fatigue (FSS)	-.456**	NE	NE	.069	-.201*	NE	NE	-.152
R ²		.114	.206	.615		.268	.318	.334
Adjusted R ²		.090	.147	.554		.239	.262	.259
ΔF			2.6	13.4**			1.8	.9

Abbreviations: QOLIBRI, Quality of Life after Brain injury; CIQ, Community Integration Questionnaire; FAI, Frenchay Activities Index; ROSC, Return Of Spontaneous Circulation; ICD, Implantable Cardioverter Defibrillator; LVEF, Left Ventricular Ejection Fraction; NYHA, New York Heart Association Functional Classification; CogLog, the Cognitive Log; BI, Barthel Index; CFQ, Cognitive Failure Questionnaire; HADS, Hospital Anxiety Depression Scales; IES, Impact of Events Scale; FSS, Fatigue Severity Scale; NE, Not Entered.

^a Response rate less than 85%.

^b In case one of the predictor variable is non-normally distributed.

* $p < 0.05$.

** $p \leq 0.001$.

is still some unexplained variance for societal participation which might be due to the CIQ being not sensitive enough. In-hospital and out-of-hospital cardiac arrest patients might have differed on outcome level but sensitivity analyses (not reported) showed that differences were negligible. Although this study created a broad framework of potential influencing factors, we still do not know how these mechanisms work. Further studies could therefore focus on identifying mediation/moderation factors. In addition, it is recommended to take psychological factors (such as coping style, self-efficacy, and neuroticism) at early stages into account, which were shown to be predictive of QOL in brain-injury populations [7,32]. Adding these factors to the models may further explain the variance.

Implications

This study makes an important contribution to clinical practice in that it revealed predictive factors of QOL one year post-cardiac arrest. This information can be used during the early phase after survival. With regard to QOL, it is more important to focus on the functional level of the survivor at two weeks post-cardiac arrest than cardiac arrest related variables. Special attention is furthermore needed for those without a partner and/or with a neurological history, as they are more likely to experience lower QOL at one year post-cardiac arrest. Furthermore, this study confirmed findings of Moolaert et al. [4], that it is important to screen emotional and cognitive complaints around three months post-cardiac arrest. We recommend the cost-effective early intervention service that we developed [33–36]. This intervention, delivered by trained nurses,

consisting of screening for cognitive and emotional problems, provision of support and information, self-management and referral to specialized health care, led to a higher QOL at one year post-cardiac arrest [36].

Conclusions

In conclusion, this study has shown that not cardiac-arrest related factors but demographic, early function-related factors and subjective well-being at three months are predictive of QOL at one year post-cardiac arrest. Societal participation showed to be predicted by premorbid functioning. For the minority of survivors who experience unfavourable outcome at one year post-cardiac arrest, screening for these predictive factors at an early stage can help to identify those at risk of poor outcome. Subsequent interventions can help to increase their QOL. A better understanding about relationships as identified, i.e. how they might interact as well as the role of psychological factors, seem subject for future research.

Conflicts of interest

None.

Author contributions

DV, VM, CH, and JV were involved in the design of the study. DV was the principle investigator on this project who performed the data analyses. DV mainly wrote the drafts of the manuscript, with assistance of VM, CH and JV. All authors take responsibility

for the integrity of the data and the accuracy of the data analysis. All authors read, critically reviewed and approved the final manuscript. JV is the guarantor.

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