Clinical decision making in cardiopulmonary resuscitation

de Vos, R.

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Chapter 6

Quality of Survival: outcomes

R. de Vos, J.C.J.M. de Haes, R.W. Koster, R.J. de Haan
Quality of survival after cardiopulmonary resuscitation. Archives of Internal Medicine (in press).
Outcome of cardiopulmonary resuscitation can be poor, in terms of life expectancy and quality of life. We determined the impact of patient characteristics before, during and after resuscitation on these outcomes, and compared results of the quality of life assessment with published studies.

Methods
In a cohort study of survivors after in-hospital resuscitation, we assessed various quality of life domains, including cognitive functioning, depression and level of dependence. Follow-up was at least three months after discharge from the hospital.

Results
Of 827 resuscitated patients, 12% (n=101) had a survival duration of at least 3 months at the time of the interview. Of the 101 survivors 89% participated in the study. Most survivors were independent in daily life (75%), 17% were cognitive impaired, 16% had depressive symptoms. Multivariate regression analysis showed that impaired quality of life and cognitive dysfunctioning were partly determined by two factors known before resuscitation: noncardiac reason for admission and older age. Factors during and after resuscitation, such as prolonged cardiac arrest and coma, did not importantly determine the quality of life or cognitive functioning of survivors. The quality of life of our resuscitation survivors was worse compared to a reference group of elderly, but better than that of a reference group of stroke patients. Quality of life did not importantly differ between the compared studies of resuscitation survivors.

Conclusions
Resuscitation is frequently not successful, but if survival is achieved, a relatively good quality of life can be expected. Quality of life after resuscitation is mostly determined by factors known before resuscitation. These findings may be helpful when informing patients and taking decisions about resuscitation.
Cardiopulmonary resuscitation can only be called successful if the patient survives, and his quality of life is acceptable. Neurologic impairments caused by the cardiac arrest can be a threat to this quality of life.\textsuperscript{1,2,3} Quality of life comprises at least physical, psychologic and social functioning.\textsuperscript{4} All these dimensions have been described in relation to resuscitation separately, but not in relation to each other.\textsuperscript{2,3,5-9} In view of the risks of resuscitation, it is important to get an overall insight into quality of life after resuscitation and how this relates to the procedure.

The objective of this study was to determine the outcomes of resuscitation, in terms of quality of life, and relate important patient characteristics before, during and after resuscitation to this outcome. We aimed to widen this perspective by comparing quality of life between different groups of resuscitation survivors and between different patient populations as known from the literature.

**PATIENTS AND METHODS**

The study was carried out in the Academic Medical Center in Amsterdam (tertiary care hospital, 1030 beds, 26,000 admissions per year). Cardiopulmonary resuscitation was defined as either the application of artificial ventilation and external chest compression or immediate defibrillation. Survivors were identified through the database of calls for the resuscitation team since May 1988, in which patient and procedure variables were prospectively entered. The team is routinely called to all wards and emergency room. The coronary care unit calls if the resuscitation exceeds a few defibrillator shocks.

We included all consecutive survivors (age $\geq$ 18 years) discharged from the hospital since May 1988, including those with an out-of-hospital onset of cardiac arrest. Patients with a survival of at least three months were studied. The maximum follow-up period was 6 years. The study was approved by the hospital medical ethics committee.

**Patient characteristics**

We distinguished between characteristics before, during and after resuscitation. Characteristics before resuscitation were age, sex, dependency in daily life before cardiac arrest and (non)cardiac reason for admission. With regard to characteristics during admission, we focussed on the location of resuscitation (in-hospital, out-of-hospital) and duration of resuscitation (minutes). Patient characteristics after CPR were expressed in terms of duration of coma (hours) and survival duration (months) at the time of the interview.

**Assessment instruments**

Quality of life was evaluated by physical, psychologic and social functioning.
Cognitive functioning, depression and dependence in daily life were assessed in depth. Questionnaires were selected by their psychometric properties and use in other resuscitation studies. Quality of life was measured with the 136-item self-reporting Sickness Impact Profile (SIP) with 12 subscales and three aggregated scores (physical, psychosocial and overall health). The SIP scores range from 0 to 100, higher scores indicate a worse quality of life. Perceived quality of life was expressed by the patients on a visual analogue scale ranging from 0 (worst) to 10 (best) as answer to the question ‘how do you rate your quality of life over the past 14 days’. Cognitive functioning was assessed with the 30-item Mini Mental State Examination (MMSE). Patients were classified as cognitive impaired at a cut-off value of < 23. Depression was measured with the 20-item self-reporting Center for Epidemiologic studies Depression scale (CES-D). Patients had depressive symptoms at a cut off value of ≥ 16. Dependence in daily life was assessed with the 6-point observer-rated Rankin Scale (RS). The categories are: no symptoms (0), minor symptoms that do not interfere with lifestyle (1), symptoms that lead to some restriction in life style but do not interfere with the patient's capacity to look after himself (2), symptoms that prevent a totally independent existence (3), symptoms that clearly prevent independent existence though constant attention is not needed (4), and a totally dependent patient requiring constant attention night and day (5).

Quality of life in perspective
We compared the quality of life of our study group to that of similar populations of resuscitation survivors, but after out-of-hospital cardiac arrest and cardiac arrest at the intensive care. An open Dutch population of elderly people and an age corrected subsample of stroke patients served as reference groups to indicate where the quality of life outcomes of resuscitation survivors can be positioned between two relatively extreme health states of patients with about the same age.

Statistical analysis
The patient characteristics before, during and after resuscitation were associated with the mortality as well as with the quality of life after survival by calculating Chi square statistic for nominal variables and using a Student’s t-test or analysis of variance for continuous variables. In case of skewed data or ordinal categories, we used the Mann-Whitney or Kruskall-Wallis test. A p-value of < 0.05 was considered statistically significant. The probability of survival was calculated and presented by a Kaplan-Meier survival curve where patients were censored at the time of the interview. All patient characteristics before, during and after resuscitation were entered into multivariate linear regression models (forward selection) to assess the independent effect of these factors on outcomes.
on the quality of life dimensions. The strength of the relationship was expressed in partially explained variances (partial $R^2$). The total explained variance was calculated by summarizing the partial $R^2$s.$^{18}$

The MMSE and CES-D scores were considered dichotomous according to their cut-off value. Therefore, patient characteristics before, during and after resuscitation were entered in logistic regression models (forward selection) to identify their independent effect on cognitive impairment and depression. The effect sizes of significant characteristics were expressed as Odds Ratios (OR) and their 95% confidence limits (CL).$^{19}$ To compare the quality of life of the study group with a reference group, SIP scores were converted to mean standard scores (mean scores of the study group - mean scores of the reference group / SD of the reference group). According to this method, the scores of the reference group were set at zero. Standard scores indicate the difference in standard deviations between the study group and the reference groups. Given the similarity with the effect size calculations, a mean standard score of 0.20 can be taken to indicate a small deviation from the reference data, 0.50 is a moderate deviation, and 0.80 a substantial deviation.$^{20}$

**RESULTS**

During the study period a total of 827 patients underwent resuscitation, 385 initially survived and were transferred to the intensive care or coronary care unit. As shown by the Kaplan-Meier curve (Figure 6.1) the first rapid decline in survival of the 385 patients occurred shortly after the initial successful resuscitation (within 48 hours). Mortality after discharge was significantly associated with age ≥ 70 years ($p = 0.05$), and dependency in daily life before resuscitation ($p = 0.05$). In our cohort studied, 101 patients (12%) at least survived three months, of whom 90 (89%) participated in the interview: 50 men and 40 women with a mean (SD) age of 64 (13) years. The 11 survivors who refused to participate stated that they were in good health (n=4) or bad health (n=4), or would not answer any questions on their current health (n=3).

The median time from resuscitation to interview was 15 months (range 3 – 72 months). At the time of the interview, 29 patients had a survival duration of 3–5 months, 21 patients had already survived a period of 6–24 months, 21 patients had survived a period of 25–48 months, whereas 19 patients had a survival duration of 49 to 72 months.

Of the participating survivors 41 (46%) had ventricular fibrillation as initial rhythm, 84 (93%) had a circulatory arrest of cardiac origin, and 6 (7%) of respiratory origin. Of the 84 patients with a circulatory arrest of cardiac origin, 30 (36%) arrested due to a myocardial infarction and 32 (38%) due to primary...
rhythm disturbances. Other causes of arrest were a variety of cardiac conditions, such as disturbances of the myocardial conduction system and acute heart failure.

![Kaplan-Meier survival curve of patients after resuscitation (CPR).](image)

Patients were analyzed when Advanced Life Support was successful. The first rapid decline in survival occurred shortly after the initial successful resuscitation (within 48 hours).

**Quality of life dimensions**

All 90 patients completed the SIP, four needed assistance of a relative. The mean score (SD) for the subscale physical functioning was 13.3 (15.7), for the subscale psychosocial functioning 10.5 (11.5) and for the total SIP 12.8 (12). All defined patient characteristics as known before resuscitation were significantly associated with physical functioning (Table 6.1.). Physical functioning tended to be more impaired in case of in-hospital resuscitation, prolonged coma, and an interview < 6 months after resuscitation (not statistically significant). Psychosocial functioning was significantly more impaired with a non-cardiac reason for admission and tended to be associated with dependence in daily life before resuscitation, but this was not statistically significant. The overall quality of life (total SIP) was significantly more impaired in patients of 70 years and older and those with a non-cardiac reason of admission. Prolonged coma also tended to result in a more impaired overall quality of life (not statistically significant).

The mean score (SD) for perceived quality of life as rated by patients was 7 (2) on the scale from 0 to 10. None of the studied characteristics were associated with the perceived level of quality of life.

**Cognition**

The MMSE was completed by 88 patients, mean score 27 (4.3), two refused to complete the MMSE; 15 patients (17%) were classified as cognitive impaired at the cut-off point of ≤ 23. Cognitive dysfunctioning was significantly associated with age ≥ 70 years and a non-cardiac reason for admission.
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<th>Median (Range)</th>
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<td>49-72</td>
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<tr>
<td>Age 70 years</td>
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<td>Male</td>
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<td>32</td>
<td>40</td>
<td>50</td>
<td>49-72</td>
<td>25-48</td>
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<td>Independence in daily life</td>
<td>before CPR</td>
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<td>11 (10)</td>
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Table 6.1. Association of patient characteristics with quality of life after CPR.
Duration of resuscitation and coma were not significantly associated with the MMSE scores.

**Depression**
The CES-D was completed by 86 patients. Four patients were not capable to complete the CES-D. The mean score (SD) was 8 (8.1). At the cut-off point ≥ 16, 14 patients (16%) were classified as having depressive symptoms. No specific factor was significantly associated with depression.

**Dependence in daily life**
The Rankin scale (RS) was scored for all patients. Daily life was little or not limited in 66 patients (74%, RS ≤ 2). Twelve (13%) had restrictions in daily life, but were able to look after themselves (RS = 3). Twelve patients (13%) were partially or totally dependent (RS ≥ 4). Age ≥ 70 years and a noncardiac admission (p = 0.05) were significantly associated with dependence in daily life after resuscitation.

**Independent characteristics explaining quality of life**
After entering all clinical characteristics in linear regression models, mainly the characteristics before resuscitation could explain the level of quality of life after resuscitation (Table 6.2.). The partial variances explained were relatively low. An impaired physical functioning and dependence in daily life could be partially explained by multiple factors (non-cardiac reason for admission, older age, prolonged duration of coma). An impaired psychosocial and total functioning could be explained by a single factor (noncardiac reason for admission). By logistic regression, a non cardiac reason for admission was identified as the only independent risk factor for cognitive impairments (OR 10, 95% CL 3 - 36). Multivariate analysis was not performed on perceived quality of life and depressive symptoms, because no significant associated characteristics could be identified at the univariate level.

**Quality of life differences between patient populations**
The comparison of the profile of our SIP scores to that of: (a) survivors after out-of-hospital cardiac arrest; and (b) survivors after cardiac arrest at the intensive care is shown in Figure 6.2. The quality of life of our study group did not importantly differ from the reference groups of survivors of out-of-hospital resuscitation and resuscitation at the intensive care. The comparison of the profile of SIP scores of our study group to that of (a) a open population of 132 Dutch elderly people (age range 61-75 years); and (b) an age corrected subsample of 441 Dutch stroke patients (mean age 64 years) is shown in Figure 6.3. Quality of life of resuscitation survivors was substantially worse (higher scores) compared to the elderly, except for mobility, social interaction,
alertness behavior and communication, but better (lower scores) than that of stroke patients, particularly in body care and movement, communication and eating.

Table 6.2. **Independent patient characteristics explaining quality of life after resuscitation**

<table>
<thead>
<tr>
<th></th>
<th>Linear regression models</th>
<th>Rankin dependence daily life</th>
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<tr>
<td></td>
<td>SIP physical dysfunctioning</td>
<td>SIP psychosocial dysfunctioning</td>
</tr>
<tr>
<td></td>
<td>partial $R^2$</td>
<td>partial $R^2$</td>
</tr>
<tr>
<td><strong>Before resuscitation</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>sex</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>age &gt; 70 years</td>
<td>5%</td>
<td>-</td>
</tr>
<tr>
<td>dependence in daily life</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>noncardiac admission</td>
<td>15%</td>
<td>5%</td>
</tr>
<tr>
<td><strong>During resuscitation</strong></td>
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<td>-</td>
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<tr>
<td>location</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>duration of arrest</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td><strong>After resuscitation</strong></td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>prolonged coma duration</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>survival duration</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td><strong>Total $R^2$</strong></td>
<td>20%</td>
<td>5%</td>
</tr>
</tbody>
</table>

- = not an independent factor explaining quality of life after resuscitation

**DISCUSSION**

A commonly expressed fear is that resuscitation results in a poor quality of life, particularly the worst imaginable, a vegetative state. The results of our study indicate, that quality of life after resuscitation in general is quite satisfactory. Of long-term survivors about 75% were independent in daily life and survivors themselves rate their quality of life at 7 on a scale of 10. The feared vegetative state occurred in only five patients, and was followed by death within several months.
Quality of survival: outcomes

Grupps' results show only small deviations in quality of life between the various study settings. The scores of survivors at the intensive care (ICU) were set at zero. A mean standard score of 0.20 can be taken to indicate a small deviation from the reference data. A mean standard score of 0.30 would represent a moderate deviation. The scores of survivors at the intensive care (ICU) were set at zero. A mean standard score of 0.20 can be taken to indicate a small deviation from the reference data.

**Figure 6.2** Quality of survival: outcomes

<table>
<thead>
<tr>
<th>Present study versus ICU</th>
<th>Out-of-hospital versus ICU</th>
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<tbody>
<tr>
<td>0.1</td>
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</table>

**Psycho-social dimension**

- Total
- Eating
- Recreation and pastimes
- Communication
- Alertness behavior
- Ambulation
- Social interaction
- Mobility
- Household management
- Body care and movement
- Emotional behavior
- Sleep & rest

**Physical dimension**

- Total
- Eating
- Recreation and pastimes
- Communication
- Alertness behavior
- Ambulation
- Social interaction
- Mobility
- Household management
- Body care and movement
- Emotional behavior
- Sleep & rest

**Mean standard scores**

- Intensive care (ICU)
- Out-of-hospital
- Present study
The scores of the reference group of elderly were set at zero. A mean standard score of 0.20 and 0.80 a substantial deviation.

The difference in mean standard scores

<table>
<thead>
<tr>
<th></th>
<th>CPB vs Elderly</th>
<th>Stroke vs Elderly</th>
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<tbody>
<tr>
<td>0</td>
<td>0.9</td>
<td>0.8</td>
</tr>
<tr>
<td>1</td>
<td>1.1</td>
<td>1.4</td>
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<tr>
<td>2</td>
<td>0.7</td>
<td>0.9</td>
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<tr>
<td>3</td>
<td>0.7</td>
<td>1.0</td>
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<td>4</td>
<td>0.8</td>
<td>1.0</td>
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</table>

Figure 6.3.  

Quality of survival: outcomes

- Physical dimension
- Psychosocial dimension
- Eating
- Recreation and pastimes
- Communication
- Alertness behavior
- Ambulation
- Social interaction
- Mobility
- Household management
- Body care and movement
- Emotional behavior
- Sleep & rest

**Mean standard scores**
Comparing our quality of life outcomes with other studies is difficult because of methodological differences. Most studies involved a small sample of patients, with a few exceptions, and outcomes were mainly assessed by clinical judgement and rarely by quantitative measurements. When comparing studies using the SIP, our data suggest that across the different studies, survivors after resuscitation have about the same quality of life, regardless the conditions under which resuscitation took place. When quality of life of our survivors after resuscitation is compared with a group of elderly, significant impairments in resuscitation survivors can be detected by all subscales of the SIP, but these impairments are of a smaller magnitude than the impairments of a group of stroke survivors.

How much of the impairments after resuscitation can be attributed to the resuscitation itself and/or the underlying disease cannot be determined by our study. However, of all determinants of quality of life studied, the noncardiac admission diagnosis in the hospital was the most important factor which could explain the various levels of quality of life. This indicates that differences in disease leading to resuscitation, rather than differences in resuscitation and recovery itself, contribute to the quality of life after resuscitation.

Also important to note is that a prolonged duration of the resuscitation did not have a negative influence on any of the dimensions of the quality of life after resuscitation, whereas a prolonged coma duration only had a small impact on dependence in daily life. We expect that more information on the condition of the patient before resuscitation will lead to a more complete explanation of their quality of life after resuscitation.

Ten percent of the survivors declined to participate in our study. We have no clear indication that this participation has influenced our study results: the few patients who refused to participate were not unanimously characterized by a poor perceived health status. However, it is to be expected that the results of our study are biased by selection through mortality. If only the most healthy patients survive, it may be that the quality of life of survivors is overestimated and that potential important determinants of poor quality of life, such as a prolonged duration of arrest and coma, remained undetected.

Short-term survivors who were interviewed within 6 months after resuscitation performed worse in physical functioning (SIP) compared to long-term survivors. This suggests that an improvement of physical health may occur over time. This result also suggests that level of quality of life after resuscitation depends on the timing of assessment. When investigating changes in quality of life over time, a longitudinal study design is required, with repeated measures and control over mortality as a potential confounding factor.

We conclude that resuscitation is frequently unsuccessful, but if (long-term) survival is achieved, a fair to good quality of life can be expected. When
deciding upon a do-not-attempt resuscitation order, we recommend not only to focus on a small probability of survival, but also to consider the relative high probability of an acceptable quality of life of the survivors.

REFERENCES