Near-death experience in survivors of cardiac arrest: a prospective study in the Netherlands

Pim van Lommel, Ruud van Wees, Vincent Meyers, Ingrid Elfferich

**Summary**

**Background** Some people report a near-death experience (NDE) after a life-threatening crisis. We aimed to establish the cause of this experience and assess factors that affected its frequency, depth, and content.

**Methods** In a prospective study, we included 344 consecutive cardiac patients who were successfully resuscitated after cardiac arrest in ten Dutch hospitals. We compared demographic, medical, pharmacological, and psychological data between patients who reported NDE and patients who did not (controls) after resuscitation. In a longitudinal study of life changes after NDE, we compared the groups 2 and 8 years later.

**Findings** 62 patients (18%) reported NDE, of whom 41 (12%) described a core experience. Occurrence of the experience was not associated with duration of cardiac arrest or unconsciousness, medication, or fear of death before cardiac arrest. Frequency of NDE was affected by how we defined NDE, the prospective nature of the research in older cardiac patients, age, surviving cardiac arrest in first myocardial infarction, more than one cardiopulmonary resuscitation (CPR) during stay in hospital, previous NDE, and memory problems after prolonged CPR. Depth of the experience was affected by sex, surviving CPR outside hospital, and fear before cardiac arrest. Significantly more patients who had an NDE, especially a deep experience, died within 30 days of CPR (p<0.0001). The process of transformation after NDE took several years, and differed from those of patients who survived cardiac arrest without NDE.

**Interpretation** We do not know why so few cardiac patients report NDE after CPR, although age plays a part. With a purely physiological explanation such as cerebral anoxia for the experience, most patients who have been clinically dead should report one.

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See Commentary page 2010

**Introduction**

Some people who have survived a life-threatening crisis report an extraordinary experience. Near-death experience (NDE) occurs with increasing frequency because of improved survival rates resulting from modern techniques of resuscitation. The content of NDE and the effects on patients seem similar worldwide, across all cultures and times. The subjective nature and absence of a frame of reference for this experience lead to individual, cultural, and religious factors determining the vocabulary used to describe and interpret the experience.

NDE are reported in many circumstances: cardiac arrest in myocardial infarction (clinical death), shock in postpartum loss of blood or in perioperative complications, septic or anaphylactic shock, electrocution, coma resulting from traumatic brain damage, intracerebral haemorrhage or cerebral infarction, attempted suicide, near-drowning or asphyxia, and apnoea. Such experiences are also reported by patients with serious but not immediately life-threatening diseases, in those with serious depression, or without clear cause in fully conscious people. Similar experiences to near-death ones can occur during the terminal phase of illness, and are called deathbed visions. Identical experiences to NDE, so-called fear-death experiences, are mainly reported after situations in which death seemed unavoidable: serious traffic accidents, mountaineering accidents, or isolation such as with shipwreck.

Several theories on the origin of NDE have been proposed. Some think the experience is caused by physiological changes in the brain, such as brain cells dying as a result of cerebral anoxia. Other theories encompass a psychological reaction to approaching death, or a combination of such reaction and anoxia. Such experiences could also be linked to a changing state of consciousness (transcendence), in which perception, cognitive functioning, emotion, and sense of identity function independently from normal body-linked waking consciousness. People who have had an NDE are psychologically healthy, although some show non-pathological signs of dissociation. Such people do not differ from controls with respect to age, sex, ethnic origin, religion, or degree of religious belief.

Studies on NDE have been retrospective and very selective with respect to patients. In retrospective studies, 5–10 years can elapse between occurrence of the experience and its investigation, which often prevents accurate assessment of physiological and pharmacological factors. In retrospective studies, between 43% and 48% of adults and up to 85% of children who had a life-threatening illness were estimated to have had an NDE. A random investigation of more than 2000 Germans showed 4-3% to have had an NDE at a mean age of 22 years. Differences in estimates of frequency and uncertainty as to causes of this experience result from varying definitions of the phenomenon, and from inadequate methods of...
We did a prospective study to calculate the frequency of NDEs in patients after cardiac arrest (an objective critical medical situation), and establish factors that affected the frequency, content, and depth of the experience. We also did a longitudinal study to assess the effect of time, memory, and suppression mechanisms on the process of transformation after NDE, and to reaffirm the content and allow further study of the experience. We also proposed to reassess theories on the cause and content of NDE.

**Methods**

**Patients**

We included consecutive patients who were successfully resuscitated in coronary care units in ten Dutch hospitals during a research period varying between hospitals from 4 months to nearly 4 years (1988–92). The research period varied because of the requirement that all consecutive patients who had undergone successful cardiopulmonary resuscitation (CPR) were included. If this standard was not met we ended research in that hospital. All patients had been clinically dead, which we established mainly by electrocardiogram records. All patients gave written informed consent. We obtained ethics committee approval.

**Procedures**

We defined NDE as the reported memory of all impressions during a special state of consciousness, including specific elements such as out-of-body experience, pleasant feelings, and seeing a tunnel, a light, deceased relatives, or a life review. We defined clinical death as a period of unconsciousness caused by insufficient blood supply to the brain because of inadequate blood circulation, breathing, or both. If, in this situation, CPR is not started within 5–10 min, irreparable damage is done to the brain and the patient will die.

We did a short standardised interview with sufficiently well patients within a few days of resuscitation. We asked whether patients recollected the period of unconsciousness, and what they recalled. Three researchers coded the experiences according to the weighted core experience index.\(^1\) In this scoring system, depth of NDE is measured with weighted scores assigned to elements of the content of the experience. Scores between 1 and 5 denote superficial NDE, but we included these events because all patients underwent transformational changes as well. Scores of 6 or more denote core experiences, and scores of 10 or greater are deep experiences. We also recorded date of cardiac arrest, date of interview, sex, religion, standard of education reached, whether the patient had previously experienced NDE, previously heard of NDE, whether CPR took place inside or outside hospital, previous myocardial infarction, and how many times the patient had been resuscitated during their stay in hospital. We estimated duration of circulatory arrest and unconsciousness, and noted whether artificial respiration by intubation took place. We also recorded typical medical problems (including two or more drugs before, during, and after the crisis), and assessed possible memory problems at interview after lengthy or difficult resuscitation. We classed patients resuscitated during electrophysiological stimulation separately.

We did standardised and taped interviews with participants a mean of 2 years after CPR. Patients also completed a life-change inventory.\(^1\) The questionnaire addressed self-image, concern with others, materialism and social issues, religious beliefs and spirituality, and attitude towards death. Participants answered 34 questions with a five-point scale indicating whether and to what degree they had changed. After 8 years, surviving patients and their partners were interviewed again with the life-change inventory, and also completed a medical and psychological questionnaire for cardiac patients (from the Dutch Heart Foundation), the Utrecht coping list, the sense of coherence inquiry, and a scale for depression. These extra questionnaires were deemed necessary for qualitative analysis because of the reduced number of respondents who survived to 8 years follow-up. Our control group consisted of resuscitated patients who had not reported an NDE. We matched controls with patients who had had an NDE by age, sex, and time interval between CPR and the second and third interviews.

**Statistical analysis**

We assessed causal factors for NDE with the Pearson \(\chi^2\) test for categorical and \(t\) test for ratio-scaled factors. Factors affecting depth of NDE were analysed with the Mann-Whitney test for categorical factors, and with Spearman’s coefficient of rank correlation for ratio-scaled factors. Links between NDE and altered scores for questions from the life-change inventory were assessed with the Mann-Whitney test. The sums of the individual scores were used to compare the responses to the life-change inventory in the second and third interview. Because few causes or relations exist for NDE, the null hypotheses are the absence of factors. Hence, all tests were two-tailed with significance shown by \(p\) values less than 0·05.

**Results**

**Patients**

We included 344 patients who had undergone 509 successful resuscitations. Mean age at resuscitation was 62·2 years (SD 12·2), and ranged from 26 to 92 years. 251 patients were men (73%) and 93 were women (27%). Women were significantly older than men (66 vs 61 years, \(p=0.005\)). The ratio of men to women was 57/43 for those older than 70 years, whereas at younger ages it was 80/20. 14 (4%) patients had had a previous NDE. We interviewed 248 (74%) patients within 5 days after CPR. Some demographic questions from the first interview had too many values missing for reliable statistical analysis, so data from the second interview were used. Of the 74 patients whom we interviewed at 2-year follow-up, 42 (57%) had previously heard of NDE, 53 (72%) were religious, 25 (34%) had left education aged 12 years, and 49 (66%) had been educated until aged at least 16 years.

296 (86%) of all 344 patients had had a first myocardial infarction and 48 (14%) had undergone more than one infarction. Nearly all patients with acute myocardial infarction were treated with fentanyl, a synthetic opioid antagonist; thalamonal, a combined preparation of fentanyl with dehydrobenzperidol that has an antipsychotic and sedative effect; or both. 45 (13%) patients also received sedative drugs such as diazepam or oxazepam, and 38 (11%) were given strong sedatives such as midazolam (for intubation), or haloperidol for cerebral unrest during or after long-lasting unconsciousness.
ARTICLES

Table 1: Distribution of the 344 patients in five WCEI classes

<table>
<thead>
<tr>
<th>WCEI score*</th>
<th>n</th>
</tr>
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<tbody>
<tr>
<td>A No memory</td>
<td>0</td>
</tr>
<tr>
<td>B Some recollection</td>
<td>1–5</td>
</tr>
<tr>
<td>C Moderately deep NDE</td>
<td>6–9</td>
</tr>
<tr>
<td>D Deep NDE</td>
<td>10–14</td>
</tr>
<tr>
<td>E Very deep NDE</td>
<td>15–19</td>
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</tbody>
</table>

*WCEI=weighted core experience index. NDE=near-death experience. *A=no NDE. B=superficial NDE. C/D/E=core NDE.

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patients were able to retell their experience almost exactly. Of the 17 patients who had low scores in the first interview (superficial NDE), seven had unchanged low scores, and four probably had, in retrospect, an NDE that consisted only of positive emotions (score 0). Six patients had not in fact had an NDE after all, which was probably because of our wide definition of NDE at the first interview.

We selected a control group, matched for age, sex, and time since cardiac arrest, from the 282 patients who had not had NDE. We contacted 75 of these patients to obtain 37 survivors who agreed to be interviewed. Two controls reported an NDE consisting only of positive emotions, and two a core experience. The first interview after CPR might have been too soon for these four patients (1% of total) to remember their NDE, or to be willing or able to describe the experience. We were therefore able to interview 35 patients who had had an affirmed NDE, and 39 patients who had not.

Only six of the 74 patients that we interviewed at 2 years said they were afraid before CPR (table 3). Four of these six had deep NDE (**p=0.045**, table 3). Most patients were not afraid before CPR, as the arrest happened too suddenly and unexpectedly to allow time for fear.

Significant differences in answers to 13 of the 34 items in the life-change inventory between people with and without an NDE are shown in table 4. For instance, people who had NDE had a significant increase in belief in an afterlife and decrease in fear of death compared with people who had not had this experience. Depth of

<table>
<thead>
<tr>
<th>NDE (n=62)</th>
<th>No NDE (n=282)</th>
<th>p</th>
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<tbody>
<tr>
<td>Social attitude</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Showing own feelings</td>
<td>42</td>
<td>16</td>
</tr>
<tr>
<td>Acceptance of others*</td>
<td>42</td>
<td>16</td>
</tr>
<tr>
<td>More loving, empathic*</td>
<td>52</td>
<td>25</td>
</tr>
<tr>
<td>Understanding others*</td>
<td>36</td>
<td>8</td>
</tr>
<tr>
<td>Involvement in family*</td>
<td>47</td>
<td>33</td>
</tr>
<tr>
<td>Religious attitude</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Understand purpose of life*</td>
<td>52</td>
<td>33</td>
</tr>
<tr>
<td>Sense inner meaning of life*</td>
<td>52</td>
<td>25</td>
</tr>
<tr>
<td>Interest in spirituality*</td>
<td>15</td>
<td>8</td>
</tr>
<tr>
<td>Attitude to death</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fear of death</td>
<td>47</td>
<td>16</td>
</tr>
<tr>
<td>Belief in life after death</td>
<td>36</td>
<td>16</td>
</tr>
<tr>
<td>Others</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Interest in meaning of life</td>
<td>52</td>
<td>33</td>
</tr>
<tr>
<td>Understanding oneself</td>
<td>58</td>
<td>8</td>
</tr>
<tr>
<td>Appreciation of ordinary things</td>
<td>78</td>
<td>41</td>
</tr>
</tbody>
</table>

**NDE=near-death experience.** 35 patients had NDE, 39 had not had NDE. 1 value missing for patients with NDE in all categories; 2 values missing for patients with NDE (ie, n=33).
people who did not have NDE had become more emotionally affected, and in some, fear of death had decreased more than at 2-year follow-up. Their interest in spirituality had strongly decreased. Most patients who did not have NDE did not believe in a life after death at 2-year or 8-year follow-up (table 5). People with NDE had a much more complex coping process: they had become more emotionally vulnerable and empathic, and often there was evidence of increased intuitive feelings. Most of this group did not show any fear of death and strongly believed in an afterlife. Positive changes were more apparent at 8 years than at 2 years of follow-up.

**Discussion**

Our results show that medical factors cannot account for occurrence of NDE; although all patients had been clinically dead, most did not have NDE. Furthermore, seriousness of the crisis was not related to occurrence or depth of the experience. If purely physiological factors resulting from cerebral anoxia caused NDE, most of our patients should have had this experience. Patients’ medication was also unrelated to frequency of NDE. Psychological factors are unlikely to be important as fear was not associated with NDE.

The 18% frequency of NDE that we noted is lower than reported in retrospective studies, which could be because our prospective study design prevented self-selection of patients. Our frequency of NDE is low despite our wide definition of the experience. Only 12% of patients had a core NDE, and this figure might be an overestimate. When we analysed our results, we noted that one hospital that participated in the study for nearly 4 years, and from which 137 patients were included, reported a significantly (p=0.01) lower percentage of NDE (8%), and significantly (p=0.05) fewer deep experiences. Therefore, possibly some selection of patients occurred in the other hospitals, which sometimes only took part for a few months. In a prospective study with the same design as ours, 6% of 63 survivors of cardiac arrest reported a core experience, and another 5% had memories with features of an NDE (low score in our study); thus, with our wide definition of the experience, 11% of these patients reported an NDE. Therefore, true frequency of the experience is likely to be about 10%, or 5% if based on number of resuscitations rather than number of resuscitated patients. Patients who survive several CPRs in hospital have a significantly higher chance of NDE (table 3).

We noted that the frequency of NDE was higher in people younger than 60 years than in older people. In other studies, mean age at NDE is lower than our estimate (62-2 years) and the frequency of the experience is higher. Morse saw 85% NDE in children, Ring noted 48% NDE in people with a mean age of 37 years, and Sabom saw 43% NDE in people with a mean age of 49 years; thus, age and the frequency of the experience seem to be associated. Other retrospective studies have noted a younger mean age for NDE: 32 years, 29 years, and 22 years.

Cardiac arrest was the cause of the experience in most patients in Sabom’s study, whereas this was the case in only a low percentage of patients in other work. We saw that people surviving CPR outside hospital (who underwent deeper NDE than other patients) tended to be younger, as were those who survived cardiac arrest in a first myocardial infarction (more frequent NDE), which indicates that age was probably decisive in the significant relation noted with those factors.
Research should be concentrated on the effort to explain scientifically the occurrence and content of NDE. Research should be focused on certain specific elements of NDE, such as out-of-body experiences and other verifiable aspects. Finally, the theory and background of transcendence should be included as a part of an explanatory framework for these experiences.

Contributors
Pim van Lomme coordinated the first interviews and was responsible for collecting all demographic, medical, and pharmacological data. Pim van Lomme, Ruud van Wees, and Vincent Meyers rated the first interview. Ruud van Wees and Vincent Meyers coordinated the second interviews. Ruud van Wees did statistical analysis of the first and second interviews. Ingrid Eilferich did the third interviews and analysed these results.

Acknowledgments
We thank nursing and medical staff of the hospitals involved in the research; volunteers of the International Association of Near Death Studies; IANDS-Netherlands; Merkawah Foundation for arranging interviews, and typing the second and third interviews; Martin Meyers for help with translation; and Kenneth Ring and Bruce Greyson for review of the article.

References
A 67-year-old man presented with haemoptysis and macular erythema on both legs. He had longstanding congestive heart failure and was treated with quinapril, digitalis, furosemide and phenprocoumon. He had been taking amiodarone for 4 years to treat unsustained bouts of ventricular tachycardia. An isolated pulmonary mass of 5 cm in diameter with central necrosis was found in the right upper lobe with extrinsic compression of the corresponding bronchus (figure, upper). Transbronchial biopsies showed no abnormalities, the skin biopsy showed lymphocytic vasculitis of the small capillaries. Antibody screening and urinalysis were normal. On follow-up the mass decreased, new infiltrates appeared and the TSH level increased to 37 mU/L (normal 0.1–4). The diagnosis of amiodarone-induced pulmonary mass and cutaneous vasculitis was confirmed by complete resolution of the infiltrates within 4 months after cessation of amiodarone therapy.