Původní sdělení | Original research article

Prevalence of Near-Death Experiences (NDE) in Patients with Refractory Cardiac Arrest Treated with Conventional and Extracorporeal Cardiopulmonary Resuscitation

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ARTICLE INFO

Article history:
Submitted: 1. 12. 2024
Revised: 5. 2. 2025
Accepted: 28. 2. 2025
Available online: 6. 6. 2025

Klíčová slova:
Extrakorporální kardiopulmonální resuscitace
Extrakorporální membránová oxygenace
Kardiopulmonální resuscitace
Zážitky blízké smrti

SOUHRN

Cíl: Zážitky blízké smrti (near death experience, NDE) dosud nebyly studovány u pacientů s refrakterní srdeční zástavou léčených extrakorporální kardiopulmonální resuscitací (ECPR). Cílem tohoto pilotního projektu bylo zjistit výskyt NDE u pacientů z randomizované studie refrakterních srdečních zástav Prague OHCA a analyzovat rozdíly mezi pacienty resuscitovanými standardní kardiopulmonální resuscitací (KPR) a pacienty resuscitovanými metodou ECPR.
Metodika: Analýza NDE pomocí standardizovaného mezinárodně používaného dotazníku pacientů z randomizované studie Prague OHCA s dlouhodobým přežitím. Srovnání výskytu NDE u pacientů po srdeční zástavě léčených standardní KPR a pacientů resuscitovaných metodou ECPR.
Výsledky: Dotazník vyplnilo 44 z 60 pacientů, kteří byli dlouhodobě sledováni po studii Prague OHCA (medián věku 57,5 roku, 83 % muži, průměrná délka KPR 37,5 min), z toho 12 pacientů léčených ECPR (průměrná délka srdeční zástavy 54 min). Alespoň jeden příznak NDE prožilo celkem 15/44 pacientů (34,1 %), z toho 10/32 (31,3 %) ve skupině standardní KPR a 5/12 (41,6%) ve skupině ECPR (p = 0,52). Kritéria kompletní NDE (28 a více bodů v dotazníku NDE) splňovalo celkem 9/44 pacientů (20,5 %), z toho 6/32 (18,8 %) ve skupině standardní KPR a 3/12 (25 %) ve skupině ECPR (p = 0,65).
Závěr: Výskyt NDE v našem souboru pacientů s refrakterní srdeční zástavou odpovídá výskytu NDE v dosud publikovaných studiích, které analyzovaly pacienty léčené standardní KPR s kratší délkou srdeční zástavy. Numericky vyšší počet NDE u pacientů léčených strategií ECPR je hypotézu generující a nedosáhl statistické významnosti. Pro další závěry je nutná analýza větší kohorty pacientů.

Keywords:
Cardiopulmonary resuscitation
Extracorporeal cardiopulmonary resuscitation
Extracorporeal membrane oxygenation
Near-death experience

ABSTRACT

Objective: Near-death experiences (NDE) have not yet been studied in patients with refractory cardiac arrest treated with extracorporeal cardiopulmonary resuscitation (ECPR). The aim of this pilot project was to determine the prevalence of NDEs in patients from the randomized Prague OHCA study with refractory cardiac arrest and to analyze differences between patients resuscitated with standard cardiopulmonary resuscitation (CPR) and those resuscitated using the ECPR method.
Methods: NDEs were analyzed using a standardized and internationally validated questionnaire among long-term survivors of the randomized Prague OHCA study. The prevalence of NDEs was compared between patients treated with standard CPR and those resuscitated with the ECPR method.
Results: The questionnaire was completed by 44 out of 60 patients who were followed up long-term after the Prague OHCA study (median age: 57.5 years, 83% male, average CPR duration: 37.5 minutes), including 12 patients treated with ECPR (average cardiac arrest duration: 54 minutes). At least one symptom of NDE was experienced by 15/44 patients (34.1%), including 10/32 (31.3%) in the standard CPR group and 5/12 (41.6%) in the ECPR group (p = 0.52). Criteria for a complete NDE (score ≥28 on the NDE questionnaire) were met by 9/44 patients (20.5%), including 6/32 (18.8%) in the standard CPR group and 3/12 (25%) in the ECPR group (p = 0.65).

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DOI: 10.33678/cor.2025.031

Please cite this article as: Kovářová JT, Rob D, Trantina F, Bělohlávek J. Prevalence of Near-Death Experiences (NDE) in Patients with Refractory Cardiac Arrest Treated with Conventional and Extracorporeal Cardiopulmonary Resuscitation. Cor Vasa 2025;67:331–335.

Conclusion: The prevalence of NDEs in our cohort of patients with refractory cardiac arrest corresponds to the prevalence reported in previous studies that analyzed patients treated with standard CPR and shorter durations of cardiac arrest. The numerically higher occurrence of NDEs in patients treated with the ECPR strategy is hypothesis-generating but did not reach statistical significance. Further conclusions require analysis in larger patient cohorts.

Introduction

Near-death experiences (NDEs) are defined as specific cognitive phenomena occurring during periods of unconsciousness in life-threatening situations, including cardiac arrest.[1]

NDEs have been a long-studied topic, and extensive multicenter studies on NDEs have been published in prominent scientific journals.[2–4] Guidelines[1] have also established a strictly scientific approach to studying this phenomenon.

In the context of care for critically ill and dying patients, NDEs can provide benefits. For these patients, NDEs may bring reconciliation with mortality, reduce fear of dying, and help manage physical and emotional pain. For relatives and caregivers, the NDE phenomenon can offer a new perspective on death as a natural part of life, improving care quality and easing the grieving process.[5,6]

Modern medicine, with new techniques, increasingly intervenes at the boundary between life and death. However, NDEs have mostly been analyzed in patients treated with standard cardiopulmonary resuscitation (CPR) with relatively short cardiac arrest durations.[2–4] In recent years, the global use of extracorporeal cardiopulmonary resuscitation (ECPR) has increased for patients with refractory cardiac arrest unresponsive to standard CPR. ECPR involves connecting the patient to venoarterial extracorporeal membrane oxygenation (VA ECMO) during resuscitation. This method allows survival in selected patients even after more than 60 minutes of unsuccessful conventional CPR.[7] However, NDEs have not yet been analyzed in this cohort.

The Prague OHCA study, published in 2022, is the largest randomized study to date focused on refractory cardiac arrest. It compares standard CPR with invasive treatment that includes early transport to a cardiac center, the use of ECPR for patients without return of circulation, and early invasive diagnosis and treatment of the cardiac arrest cause.[7]

This study aimed to determine the prevalence and characteristics of NDEs in survivors of refractory cardiac arrest treated with conventional CPR and the advanced ECPR method.

Materials and methods

We based our analysis on a cohort of patients who participated in the randomized Prague OHCA study.[7] Conducted between March 2013 and October 2020, this study was a collaboration between Prague Emergency Medical Services and the cardiac center of the General University Hospital in Prague. It compared two approaches for patients with out-of-hospital cardiac arrest: standard CPR and an invasive approach involving early transport to a cardiac center using mechanical chest compression, emergency VA ECMO (ECPR) for patients without restored circulation during transport, and early invasive diagnosis and treatment.

During long-term follow-up after cardiac arrest, patients who provided informed consent completed a standardized international NDE questionnaire. We obtained permission from the authors[8] to use the internationally recognized NDE questionnaire for Czech patients. The questionnaire was translated into Czech and validated through reverse translation into English. This made it suitable for use by Czech physicians and patients (**appendix 1**).

The NDE questionnaire, developed over decades, is based on statements from hundreds of patients. It was first published in 1983 with 16 questions.[9] Its latest version, from 2020,[8] includes 20 questions, with patients rating their experiences on a 0–4 scale corresponding to the intensity of their experience. The total score can reach a maximum of 80 points, with a score of 28 or higher indicating the presence of an NDE.

Our goal was to verify the prevalence and extent of NDEs in patients with refractory cardiac arrest treated with standard CPR compared to those treated with ECPR. Fisher's exact test was used to compare parameters between the two groups. Statistical significance was assessed at a significance level of 0.05.

Results

Survival of patients with good neurological outcomes (CPC 1–2)[9] at 180-day post-cardiac arrest was 31.5% in the invasive ECPR arm and 22% in the standard CPR arm.[7]

In the long-term follow-up cohort of patients from the Prague OHCA study, there were a total of 60 survivors at the time of our investigation (3/2022–5/2022), with an average age of 57 years, 83% male, and an average CPR duration of 37.5 minutes.

A total of 44/60 patients agreed to complete the NDE questionnaire.

At least one symptom of an NDE was reported by 15/44 patients (34.1%)–10/32 (31.3%) in the CPR arm and 5/12 (41.6%) in the ECPR arm, *p*-value 0.52.

A complete NDE score (≥28 points) was achieved by 9/44 patients (20.5%)–6/32 (18.8%) in the CPR arm and 3/12 (25%) in the ECPR arm, *p*-value 0.65.

Table 1 provides a more detailed overview of the questionnaire results for individual items.

Table 1 – NDE in CPR vs. ECPR

Pattern	Characteristics	CPR (%)	ECPR (%)	*p-value*
NDE-1	Time perception	21.88	50.00	0.135
NDE-2	Speeded thoughts	15.63	16.67	1.000
NDE-3	Voice	6.25	25.00	0.116
NDE-4	Understanding	12.50	25.00	0.116
NDE-5	Peacefulness	18.75	25.00	0.369
NDE-6	Harmony/unity	15.63	8.33	1.000
NDE-7 core	Bright light	12.50	16.67	0.658
NDE-8	Unusual sensation	28.13	33.33	0.729
NDE-9	Extrasensory perception	15.63	25.00	0.663
NDE-10	Precognition	6.25	8.33	1.000
NDE-11 core	Out of body experience	6.25	8.33	1.000
NDE-12 core	Leaving earthly world	18.75	16.67	1.000
NDE-13	Life review	9.38	8.33	1.000
NDE-14	Encounter	15.63	33.33	0.227
NDE-15	Non-existence/void/fear	15.63	25.00	0.663
NDE-16 core	Border/point of no return	9.38	8.33	1.000
NDE-17 core	Decision to come back	12.50	16.67	0.658
NDE-18 core	Dying	12.50	25.00	0.369
NDE-19 core	Gateway	9.38	16.67	0.603
NDE-20	Ineffability	12.50	41.67	0.087

Discussion

Our pilot study is the first to investigate the prevalence of near-death experiences (NDEs) in patients with refractory cardiac arrest treated not only with standard CPR but also using the ECPR method. The results showed that the prevalence of NDEs in the observed cohort aligns with previously published studies that analyzed patients treated exclusively with standard CPR with shorter cardiac arrest durations.

The numerically higher prevalence of NDEs in patients treated with the ECPR strategy may be attributed to the longer duration of cardiac arrest and the potential impact of circulatory support and reperfusion on neurocognitive processes. While this difference was not statistically significant, it may be hypothesis-generating. Mechanisms leading to NDEs may be multifactorial, involving complex interactions between hypoxia, neurocognitive activity, and the patient's subjective perception during critical conditions.

One limitation of our study is the small cohort size, which limits the statistical power and generalizability of our results. Additionally, potential selection bias should be considered, as only patients with long-term survival and good neurological outcomes (CPC 1–2) were included in the analysis. It is possible that patients with more severe neurological impairments or those who died during hospitalization may have had different experiences. Furthermore, the subjective nature of NDEs may be influenced by individual factors such as cultural, religious, or psychological background.

Nonetheless, our study represents an important step toward understanding this phenomenon in the context of advanced resuscitation care. The findings suggest that the ECPR method, which enables the survival of patients with prolonged cardiac arrest, provides a unique opportunity for further study of neurocognitive phenomena such as NDEs.

Currently, the number of publications on the NDE phenomenon is increasing.[11–23] For future research, it would be appropriate to analyze larger patient cohorts and consider a broader spectrum of variables. Longitudinal follow-up of patients and their subjective accounts would also be beneficial to better understand the long-term implications of NDEs on quality of life and psychological adaptation.

The phenomenon of NDEs in the context of modern resuscitation medicine represents not only a scientific but also an ethical and philosophical challenge that may significantly influence care for critically ill patients and the support provided to their families.

Conclusion

Our pilot study demonstrates that the prevalence of NDEs in patients with refractory cardiac arrest corresponds to existing findings from studies focused on patients treated with standard CPR with shorter cardiac arrest durations.

Although a numerically higher prevalence of NDEs was observed in our cohort of patients treated with the ECPR method, this difference was not statistically significant and primarily serves as a basis for hypothesis generation.

The findings suggest that advanced interventional strategies such as ECPR may offer new insights not only into survival and neurological recovery but also into the subjective experiences of patients near death. These experiences may have the potential to improve care and quality of life for patients and their families. However, further research is needed to confirm these findings and deepen our understanding.

Conflict of interest

The authors declare that they have no conflicts of interest. This publication has not been and will not be submitted for publication in another journal.

Funding

The research and publication were conducted independently of any influence from sponsors or other third parties that could affect the data or conclusions.

Ethical statement

The study was approved by the Institutional Review Board of the General University Hospital and the First Faculty of Medicine, Charles University, Prague. The trial complied with the Declaration of Helsinki and is registered at www.clinicaltrials.gov (ClinicalTrials.gov Identifier: NCT01511666).

Informed consent

All participants were survivors of cardiac arrest who were fully conscious, clinically stable, and capable of providing informed consent at the time of questionnaire administra-

tion. Informed consent was obtained from all participants after they were provided with information about the study purpose, voluntary nature, and confidentiality measures. All data were anonymized to protect participants privacy.

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Appendix 1

Otázky pro pacienty po srdeční zástavě

Zažil(a) jste situaci, kdy se bojovalo o váš život a podařilo se to. Zajímaly by nás vaše zážitky.
Zkuste nám, prosím, zodpovědět následujících 20 otázek.
Odpovídejte zaškrtnutím čísla:
0 – ne, vůbec
1 – mírně
2 – středně
3 – silně (ekvivalent k jinému silnému životnímu zážitku)
4 – extrémně (víc než cokoli jiného v mém životě)
Budeme rádi, když své odpovědi rozvedete, upřesníte nebo sdělíte něco, na co jsme se zapomněli zeptat.

1. Vaše vnímání času bylo změněné?
0 1 2 3 4

2. Vaše myšlenky se zrychlily?
0 1 2 3 4

3. Slyšel(a) jste jeden nebo více hlasů, které nepatřily žádné konkrétní osobě?
0 1 2 3 4

4. Měl(a) jste pocit náhlého porozumění všemu, co se týká vás, jiných a/nebo vesmíru?
0 1 2 3 4

5. Měl(a) jste pocit míru a/nebo duševní pohody?
0 1 2 3 4

6. Cítil(a) jste pocit harmonie, jednoty, jako byste patřil(a) k většímu celku?
0 1 2 3 4

7. Viděl(a) jste nebo cítil(a) jste se obklopen(a) zářivým světlem?
0 1 2 3 4

8. Zažil(a) jste neobvyklé vjemy – zrakové, sluchové, čichové, hmatové a/nebo chuťové?
0 1 2 3 4
(zkuste je popsat, pokud to lze)

9. Uvědomoval(a) jste si věci za hranicí toho, co vaše smysly obvykle vnímají?
0 1 2 3 4

10. Získal(a) jste vhled do budoucnosti?
0 1 2 3 4

11. Měl(a) jste pocit, že jste vně nebo oddělen(a) od svého těla?
0 1 2 3 4

12. Měl(a) jste pocit opuštění pozemského světa nebo vstupu do nové dimenze a/nebo prostředí?
0 1 2 3 4

13. Viděl(a) nebo znovuprožil(a) jste události z vaší minulosti?
0 1 2 3 4
(zkuste popsat jaké, pokud chcete)

14. Setkal(a) jste se s bytostí a/nebo s nějakým subjektem – např. zemřelým?
0 1 2 3 4

15. Zažil jste pocit neexistence, pobytu v absolutním prázdnu a/nebo strach, úzkost?
0 1 2 3 4

16. Přišel/přišla jste k hranici nebo bodu odkud není návratu?
0 1 2 3 4

17. Rozhodl(a) jste se nebo jste byl(a) přinucen(a) se vrátit zpět z tohoto prožitku?
0 1 2 3 4

18. Měl(a) jste pocit že umíráte a/nebo že jste zemřel(a)?
0 1 2 3 4

19. Viděl(a) nebo vstoupil(a) jste do brány nebo tunelu nebo dveří nebo podobné?
0 1 2 3 4
(zkuste popsat, pokud chcete)

20. Máte pocit, že zážitek nemůže být adekvátně popsán slovy?
0 1 2 3 4

Questions for patients after cardiac arrest

You have experienced a situation where your life was in danger, and it was saved. We are interested in hearing about your experiences. Please try to answer the following 20 questions.
Respond by ticking the appropriate number:
0 – not at all
1 – slightly
2 – moderately
3 – strongly
4 – extremely

1. Your perception of time was altered
0 1 2 3 4

2. Your thoughts speeded up
0 1 2 3 4

3. You heard one or several voices which did not have any material incarnation
0 1 2 3 4

4. You had the feeling of suddendly understanding everything about yourself, the others and/or the universe
0 1 2 3 4

5. You had the feeling of peace and/or well-being
0 1 2 3 4

6. You felt a sense of harmony or unity, as if you belonged to a larger whole
0 1 2 3 4

7. You saw or felt surrounded by a bright light without any determined material origin
0 1 2 3 4

8. You experienced unusual sensation (sight, hearing, smell, touch and/or taste)
0 1 2 3 4

9. You were aware of things beyond what your senses can usually perceive
0 1 2 3 4

10. You gained insightful knowledge about the future
0 1 2 3 4

11. You had the impression of being outside of, or separated from your own body
0 1 2 3 4

12. You had the sensation of leaving the earthly world or of entering a new dimension and/or enviroment
0 1 2 3 4

13. You saw or relieved events from your past
0 1 2 3 4

14. You encountered a presence and/or an entity (who might be deceased)
0 1 2 3 4

15. You had a feeling of non-existence, of being in a total void, and/or of fear
0 1 2 3 4

16. You came close to a border and/or point of no return
0 1 2 3 4

17. You made the decision, or were forced, to come back from the experience
0 1 2 3 4

18.You had the feeling of dying and/or being dead
0 1 2 3 4

19. You saw or entered a gateway (for instance a tunnel or a door)
0 1 2 3 4

20. You sense that the experience cannot be described adequately in words
0 1 2 3 4