

Near-Death Experiences (NDEs) in the Context of Contemporary Science and Historical Speculation and Doctrine

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Abstract

In medicine, life-saving procedures have advanced, resulting in more critical-condition patients being revived from a near-death state—spawning research interest in the near-death experience (NDE). Nevertheless, NDE research has been hampered by the lack of quantitative measurements—while anecdotal evidence has been abundant in comparison. Thus, a 33-item scale has been developed and promoted to distinguish NDEs from pathological brain syndromes and nonspecific stress responses.

Sociocultural influences directly affect NDEs, which appear broadly subjective and influenced by various sociocultural factors. Neurophysiology also seems to play a part in the NDE as examinations have revealed a preponderance of NDE-like experiences with ketamine, salvinorin, and N, N-Dimethyltryptamine (DMT). Neurological changes have been discerned in the brains of NDE patients, with specific imaging studies showing damage in the brain's grey and white matter (without brain stem damage).

During an NDE, patients have displayed unusual EEG activities in the temporal lobe, corresponding with feelings of “deepened emotions” and a “sense of personal destiny”. Stimulation of the subjects’ temporal lobes resulted in “memory flashbacks”, “life in review”, and a sense of a “mystical presence”. “Out-of-body” experiences have been correlated with stimulation of the right posterior temporal lobe and temporoparietal region. However, NDE patients with a complete loss of brain function have also reported NDEs.

Ongoing investigations into NDEs suggest that such experiences are associated with stored and perceived sensations in the patient. A hypnosis-based protocol has aided researchers in uncovering various types of memories—NDE, natural, and imagined events—establishing similarities between real and imagined event memories and those of an NDE. Researchers have detected specific EEG patterns in NDE patients, chiefly involving two frequency bands (high alpha and gamma), markers of memory-related activities. The patient recollection of an NDE was more associated with the delta band.

NDEs challenge current concepts regarding the interrelation of brain function and consciousness. Some prominent researchers, including Nobel laureate neurophysiologist Sir John C. Eccles, posit that humans are spiritual beings with souls existing in a spiritual world and material beings with bodies and brains existing in a material world. On the contrary, many scientists contend that this dual-existence supposition remains unsubstantiated—with the NDE as physical and physiological phenomena of a solely corporeal human being at an ultimate death.

Keywords: Altered State; Death; Memories; Out-of-Body Experience; Universal Consciousness

Abbreviations

DMT: N, N-Dimethyltryptamine; EEG: Electroencephalography; LSD: Lysergic Acid diethylamide; NDE: Near-Death Experience; NDERF: Near-Death Experience Research Foundation; NMDA: N-methyl-D-aspartate; PTSD: Post-Traumatic Stress Disorder

Introduction

Background

Some consider death to be the ultimate research frontier. The experience of death predominates discussions in religion and spirituality. For years, the book *Floating Bodies, Journey Through the Tunnel*, and *Meeting Dead People* has been read, depicting fictional journeys after death. Many religious and spiritual beliefs confirm an afterlife or reincarnation. Having an NDE is described as surviving imminent death. Although cardiac arrest stands out among all precipitating causes associated with NDEs [1,2], extreme fear can also induce an NDE.

Historical highlights

NDEs connect modern medical science and ancient Greek philosophy. According to Greek philosophy, revenants are a unique group of people who have returned from death. It was further supposed that revenants are appointed to monitor both the living and the dead and act as bridges between them. Plato, Heraclitus, and Democritus are the most prominent philosophers who addressed NDEs [3].

The rapid progress in technology and medical science has led to life-saving procedures, such as cardiopulmonary resuscitation, which has aided people in recovering from imminent death, resulting in more reported NDEs. The first described incident of NDE dates to 1740. Pierre-Jean du Monchaux, a military physician from northern France, discussed NDE in *Anecdotes de Médecine*. He explained that increased blood flow in the brain could be the possible reason for encountering such metaphysical feelings. This book was discovered by a French physician and archeologist, Dr. Phillippe Charlier [3,4].

Discussion

From a scientific perspective, NDEs have been studied, investigating death as a process wherein in the early stages, impending death be reversed. The life-saving results of recent advances in resuscitation techniques imply that death is not a point in time where brain activity ceases. Thus, the cessation of consciousness (brain activity) may not be considered the sole criterion of death [5].

Although it is problematic to understand what changes occur inside the brain at the functional and pathophysiological levels, various narratives have been used with linguistic analysis. Data from linguistic analyses are compared with anecdotes about drug experiences, searching for an association between the drug and the experience. The linguistic analyses of these subjective experiences proved valuable. In a study comparing the experiences of 625 subjects with 1500 individuals who received one of 165 psychoactive drugs, remarkable similarities were noticed after the analysis. Compared to other drugs, ketamine-induced experiences were closest to an NDE [6].

Assessment and interpretation of NDEs

The investigation of NDEs has been adversely affected by a lack of means for quantitative measurements. Thus, a scale was developed to solve this issue. Initially, a 33-item scale with 33-item scaled responses was introduced, then upgraded to a 16-item NDE scale. The final scale had high internal consistency and split-half reliability. The test-retest reliability highly correlated with Ring's Weighted Core Experience Index and differentiated those who unequivocally claimed to have had NDEs from those with qualified or questionable claims.

This newly validated scale is easily administrable and clinically valuable for distinguishing NDEs from pathological brain syndromes and nonspecific stress responses. The scale can also be standardized for further research on the mechanisms and effects of NDEs [7]. The “experience” component of an NDE is only subjected to impending death. Moreover, the experience must be lucid and exclusive of discrete or brief disorganized memories. A valid NDE must qualify with a score of seven or above on the NDE scale.

The Near-Death Experience Research Foundation (NDERF) aims to facilitate NDE research. Users of the NDERF website can share any NDEs on the website. Many sections of the NDERF website are in multiple languages and include questionnaires in twenty different languages. The NDERF website consistently topped the Google list for the term “near-death experience.” This website is one of the most reliable sources of studies related to NDEs [8].

Sociocultural influences on NDEs

NDEs are predominantly subjective and influenced by various sociocultural factors. A person undergoing cardiac arrest would have a cognitive perception depending on religious background, education, and upbringing. This finding proves that these experiences are manifestations of preconceived ideas and beliefs. The most common experience is an out-of-body experience, a reunion with ancestors and departed friends, a vision of light accompanied by joy and peace, or perceiving a border or dividing line between the living and the dead [9].

Countries like China, India, and South American, and the Middle East regions have relatively more reported NDE cases. A lower number of NDEs may be due to a lack of awareness of the phenomenon. In 1977, Osiris and Haraldsson conducted a cross-cultural study, the most extensive study on NDEs. In this study, deathbed visions were recorded 24 hours before death by the caregivers of 440 terminally ill American and Indian patients. About 91% of the patients visualized deceased people [10].

Neurophysiology of the NDE

The NDE is not clearly understood. An argument favoring NDE—based on “the consciousness theory”—was presented by neurologist Kevin Nelson, MD, and neurosurgeon Eben Alexander, III, MD. Their presentation considered whether consciousness is generated by the brain or exists as an epiphenomenon—whether consciousness exists alongside or separately from the physical nervous system [1].

This presentation and further dialogue compelled the research community to afford this phenomenon greater clinical significance [11].

NDE-like occurrences can be partially induced by hallucinogens and anesthetic drugs, such as ketamine. Electrical stimulation to the right temporal lobe or the limbic system has also induced such effects. A possible explanation of these effects could be the brain’s hallucinogenic transmitters (and endorphins) playing a role in the NDE [12].

A large-scale study seeking specific scientific explanations of the NDE revealed the prominence of NDE-like experiences using ketamine and salvinorin. Another study using various serotonergic psychedelics, including the endogenous serotonin 2A receptor agonist N, N-Dimethyltryptamine (DMT), also induced NDE-like events in the subjects.

These studies highlighted the link between certain drugs and the experience of “dying”. The findings suggested using ketamine as an experimental model for researching NDE phenomenology and considering endogenous N-methyl-D-aspartate (NMDA) antagonists, which might be released during NDEs [13].

A study by Charlotte Martial., *et al.* (2019) identified changes in brain activity and several hypnotic modulations. Five subjects were identified who agreed to take part voluntarily. All subjects experienced NDEs before. The subjects participated in reviews of memories through hypnosis. The hypnosis-induced subjective experience was compared with the conscious experience memory. Brain activities were continuously monitored by high-density electroencephalography (EEG) [14].

At the phenomenological level, NDE-like features were successfully recreated with no adverse effects. Levels of absorption and dissociation were higher during all conditions of hypnosis compared to ordinary consciousness, suggesting that the hypnosis-based protocol increased the perceived subjective experience in the recall of both memories. The recall of events was prominently associated with increased alpha activity in the frontal and posterior regions of the brain. A recent study proposed that any disruption to processing information and underlying dissociative detachment may be related to decreased frontoparietal harmony. The available data support the hypothesis that dissociation may be correlated with decreased functional connectivity among brain areas, as shown by EEG [14].

Neurological changes in the NDE

NDEs also raise the possibility that this diminished function indicates specific neurological changes in the brain during the process of death. Death mainly occurs after several acute conditions impair brain function, such as cardiac arrest, general anesthesia, and specific sleep abnormalities. A few imaging studies showed that patients who experienced NDEs have damage in the brain's grey and white matter without any possible brain stem damage.

These studies point to a few common areas of the brain associated with an NDE—the occipital cortex, frontal lobe, hippocampus, basal ganglia, amygdala, and, often, the temporoparietal junction. During cerebral hypoxia, the brain responds in ways that may induce an NDE. General anesthesia and drugs like ketamine, lysergic acid diethylamide (LSD) and cannabinoids cause euphoric states, visual hallucinations, tunnel vision, and transcendental feelings [15].

Internal sensory encounters and subjective impressions during NDEs

During an NDE, patients with unusual EEG activities in the temporal lobe reported heightened emotions and a sense of particular destiny. Stimulation of the temporal lobe in those patients showed memory flashbacks, life in review, and experience of a mystical presence [15].

Out-of-body experiences are related to stimulation of the right posterior temporal lobe and temporoparietal region. However, there are reports of people having complete loss of brain function describing NDEs in a well-designed study. This specific finding seems to contradict the mechanisms mentioned above. Patients with flat EEGs also had life-changing experiences [15].

NDEs support the idea of a “universal consciousness” that is independent of time and space. The principles of quantum physics provide a conceptual framework for exploring the ubiquitous experience of death [15,16].

Memory and the NDE

Although the mechanisms and factors of NDEs are not well understood, recent findings suggest that NDEs are correlated with “perceived” and “stored” experiences. An integrated approach involving hypnosis was utilized to improve recall and increase memory accuracy. EEG was used to investigate the characteristics of NDE memories and neural markers by comparing them to both natural and imaginary events. Ten subjects with NDE were selected using the Greyson NDE scale along with ten control subjects [17].

The hypnosis-based protocol increased the number of details in recalling memories (NDE, actual, and imagined events). The results revealed similarities between common and NDE memories. There were marked similarities in qualities like the richness of detail, self-referential perspectives, and emotional impressions. However, NDE memories decidedly differed from those of imaginary events [17].

Brain activity and the NDE

One study also detected several specific EEG patterns in NDEs. The EEG patterns of actual memory recall focus on two frequency bands: high alpha and gamma (markers of memory-related activities). NDE was associated with the theta band, a specific marker for

episodic memory. The recalling of NDEs was associated with the delta band. The delta band suggests recollection of the past and trance states, hallucinations, and other related portals to transpersonal [17].

Debate and controversy regarding NDEs

Fundamental curiosity regarding NDEs has enhanced and promoted scientific investigation partly due to improved resuscitation techniques over the past decades and the increased reporting frequency of such experiences and memories. Although the conceptual analysis of the state of consciousness has progressed gradually, it has facilitated an enhanced understanding of NDEs. Existing studies on NDEs challenge known concepts about the interrelation of brain function and consciousness. Thus, Cassola, *et al.* (2020) have suggested that a study to differentiate states of wakefulness, connectedness, and internal awareness could be conducted to investigate the NDE phenomenon [18].

Proof of Heaven: A Neurosurgeon's Journey into the Afterlife is a controversial book authored by a neurosurgeon, discussing surreal experiences when doctors were trying to revive a patient from the brink of death. The author further described contracting severe *E. coli* meningoencephalitis. Imaging results revealed extensive damage to the neocortex and brainstem that worsened as the cause remained undetected. The last recalled normal neocortical function was asking God for help, followed by incoherent and meaningless moans. This information was collected from witnesses because the patient could not recall anything. Since the cerebral cortex involves detailed conscious construction—given the severity of meningoencephalitis, developing memories during those seven days was unworkable [19].

Nobel laureate neurophysiologist Sir John C. Eccles said, "I maintain that the human mystery is incredibly demeaned by scientific reductionism, with its claim in promissory materialism to account eventually for all of the spiritual worlds in terms of patterns of neuronal activity. This belief must be classed as a superstition—in which it is accepted that humans are spiritual beings with souls existing in a spiritual world as well as material beings with bodies and brains existing in a material world" [20].

A significant number of publications suggest that NDEs support the idea of non-local consciousness theory, where consciousness could be independent of brain function. However, this hypothesis has not been confirmed as supporting evidence is inadequate and unpredictable, making its scientific explanations implausible [21].

Although the research has shifted from anecdotal recordings, the latest trends focus on proving existence without a functioning brain. However, two obstacles need to be resolved: 1) a failure to produce corroborative empirical evidence for extra-corporeal cognition when the brain is "dead" (or clinically dead), and 2) how the memory required for recall could be determined at this critical point in time [22].

A retrospective study was designed, assessing the severity and frequency of self-reported NDEs after a non-life-threatening event or coma. A comparison of data was performed regarding retrospectively acquired data of anoxic coma to data from the published prospective post-anoxic studies. The Greyson NDE scale was applied throughout the study.

The analysis of 190 reports revealed no significant differences between test groups. Most reported the manifestation of peacefulness; however, two reported negative experiences. Interestingly, the intensity of the core NDE features was higher in the retrospective anoxic cohort than in the historical data [23–25].

NDE as an "altered state" of consciousness

NDE may be an augmented or altered state of consciousness that manifests with a bias towards a person's individual beliefs and positive or negative emotional experiences. Cultural beliefs and predominant religious practices often influence the characteristics of these

experiences. The notion of a non-local mind could explain many characteristics of NDE, but to date, there is no acceptance for nonlocality by mainstream neuroscience [26]. However, the number of NDE theories being put forth and ongoing debates indicate that the NDE has attracted research interest.

Summary

Further collaboration among the various disciplines of science, philosophy, and spirituality will broaden research regarding the NDE. It can be inferred that an NDE correlates to some regions of the brain, brain functioning, and state of consciousness of the individual. However, this inference does not establish the transfer of a “human soul” to a different (spiritual versus material) realm upon death. To date, no empirical evidence suggesting such has been offered. Thus, an immense and perhaps unsurmountable gap remains between the scientific world and the spiritual realm regarding the near-death experience.

Conclusion

NDEs cast doubt on the current concepts concerning the relationship between brain function and consciousness. Certain distinguished researchers, including Nobel laureate neurophysiologist Sir John C. Eccles, postulate that humans are spiritual beings with souls enduring in a spiritual world and material beings with bodies and brains subsisting in a material world. On the contrary, many scientists contend that this dual-existence hypothesis remains unsupported—with the NDE as physical and physiological phenomena of a wholly material human being at a terminal death.

During an NDE, patients have displayed unique EEG activities in the temporal lobe, resulting in “deepened emotions” and a “sense of personal destiny” The consequent stimulation of the subjects’ temporal lobes produced “memory flashbacks”, “life in review”, and a feeling of a “mystical presence”. “Out-of-body” occurrences have been associated with stimulation of the right posterior temporal lobe and temporoparietal region. However, NDE patients with a total loss of brain function have also described NDEs.

Findings of ongoing studies into NDEs imply that such occurrences are correlated with saved and selected sensations in the patient. A hypnosis-based protocol has served researchers in revealing several types of recalls—NDE, authentic, and imaginary events—demonstrating connections between real and imaginary event memories and those of an NDE. Researchers have identified particular EEG patterns in NDE patients, mainly involving two frequency bands (high alpha and gamma), that are markers of memory-related activities. The patient remembrance of an NDE was further linked with the delta band.

Sociocultural forces immediately affect NDEs as NDEs seem considerably subjective and shaped by various sociocultural circumstances. Neurophysiology also appears to contribute to the NDE as studies have unveiled a prevalence of NDE-like experiences with ketamine, salvinorin, and the endogenous serotonin 2A receptor agonist N, N-Dimethyltryptamine (DMT). Neurological changes have been seen in the brains of NDE patients, with particular imaging studies confirming damage in the brain’s grey and white matter (without brain stem loss).

Life-saving methods have improved in medicine, appearing in more critical-condition patients recovering from a near-death state, which has generated investigations into the near-death experience. However, NDE research has been impeded by the need for quantitative measurements.

Conflict of Interest Statement

The authors declare that this paper was written in the absence of any commercial or financial relationship that could be construed as a potential conflict of interest.

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