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Lucid awareness in nonresponsive patients: A "locked-in experience" and its implications

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ABSTRACT

It is generally assumed that nonresponsive people in comatose states are unconscious, especially when it is known that their neuronal circuits are not functioning normally, for example, due to severe anoxia and medically induced comas. Nevertheless, occasional reports suggest that sometimes, patients in such conditions can be fully aware of everything that happens around them. The present publication introduces a well-documented case of this kind. It concerns a patient in Israel who was diagnosed with cerebral edema and suffered severe anoxic brain damage that had already affected his brain stem. He was put in an induced coma to minimize the brain's oxygen consumption. Still, he was expected to die within hours. However, the patient recovered unexpectedly. It turned out he had been fully conscious throughout the 44 hours he was in this coma. As a result, he was able to describe in detail every occurrence and conversation that had been held at his bedside throughout this time. This locked-in experience had an utterly traumatic impact on the patient. As a result, practices for coma patient care have been adapted and improved in Israel. We argue that it is important to raise awareness regarding the occurrence of such "paradoxical awareness" and hope that this increased recognition will help to improve the practices for coma patient care, also in other countries. Moreover, such individual case studies are vital for advancing the knowledge about the brain conditions under which it is possible to be aware – a largely neglected field of research that may have further important implications, for instance, in the context of organ donation.

KEYWORDS

Awareness during coma, ICU healthcare, locked-in experiences, near-death experiences, trauma.

INTRODUCTION

In the clinical context of coma patient care, consciousness is defined as "the state of full awareness of the self and one's relationship to the environment" (Posner et al., 2019, p. 3). This definition allows for patients being conscious albeit their body might be nonresponsive. In coma patient care, the potential degree of their consciousness is assessed operationally at the bedside by their responses to standardized tests. Testing of consciousness by staff usually involves eliciting physical responses such as what is outlined in the Glasgow Coma Scale (GCS) and the Full Outline of

UnResponsiveness coma scale (FOUR), which include eye response to minor uncomfortable stimuli, verbal responses to questions, motor responses to body pressures, and respiratory responses (Mehta & Chinthapalli, 2019; Iyer et al., 2009). These tests are important tools to identify levels of coma from the outside perspective, but they cannot detect awareness in patients who can understand what is being said at their bedside but cannot move. Until today, only comparably few prospective studies have been performed to systematically address experiences reported by people who had been unconscious or in a coma and regained their consciousness. Most of these studies were conducted in the context of research into near-death experiences (NDEs; e.g., Holden, 2009; Hou et al., 2013; van Lommel et al., 2001; Parnia et al., 2001, 2023; Rousseau et al., 2023; Sabom, 1982; Sartori, 2008; Schwaninger et al., 2002; Yamamura, 1998). Often, the focus of these investigations was to detect indications of veridical perception of events or targets in the physical environment from the perspective of out-of-body experiences (OBEs) during NDEs, and/or the experiences of patients scoring lower than the cut-off score of ≥ 7/32 for NDEs on the NDE scale (Greyson, 1983, 1990) have not been considered further. Consequently, the full spectrum of experiences reported from periods of unconsciousness is still largely unknown and under-researched. It is obvious, however, that NDEs, including OBEs, represent only a small part of the spectrum of experiences reported from states of temporary unconsciousness.

According to results of a few pioneering, more encompassing studies, 25 to 40% of patients who had been in an unresponsive state were able to hear and understand what had been said in their environment during the time of their supposed unconsciousness (Lawrence et al., 2023). One systematic survey of 100 hospital patients who were once documented to be unconscious and recovered attempted to identify all the experiences patients had during their state of apparent unconsciousness, not only NDEs (Lawrence, 1995, 1997). Of the 100 patients, only 27 had no recollection of an experience. The other patients reported different kinds of experiences that were classified as "inner consciousness" (no awareness of the external environment but an awareness of inner self; 9 persons), "perceived unconsciousness" (ability to hear, understand, and respond emotionally to what was being said but unable to respond physically or communicate; 27 persons), "distorted consciousness" (distortions of perception, memory, or personality; 14 persons), and "paranormal experiences" (out-of-body experiences, pleasurable and distressing NDEs, end-of-life visions; 23 persons). Two or more of these experiences can also occur successively during a phase of apparent unconsciousness in the same person. Different kinds of experiences reported by cardiac survivors have also been described in a recent study, some of them being described as very distressing (Parnia, 2023).

In a recent book devoted specifically to experiences reported by patients who recovered from medically induced comas, the authors problematized several aspects of these states (Pearce & Pearce, 2024). The focus of this treatise rests on deeply traumatizing and unforgettable experiences that are usually subsumed under the term and concept of "ICU delirium." However, systematic studies into the contents of ICU delirium and/or coma experiences are still needed, and there are indications that their variety and experiential depth have largely been underestimated in the medical setting. For example, the patients may have experienced being cruelly tortured for prolonged periods of time or may have spent years from a subjective perspective in seemingly other realms of existence – even if the coma itself lasted only days or weeks. These bewildering experiences frequently appear perfectly real or even "more real than real" to those who report them (Pearce & Pearce, 2024).

This experiential attribute is untypical for delirium, which is rather defined as a fluctuating disturbance in attention (e.g., reduced ability to focus and sustain attention) plus additional disturbance in cognition (e.g., memory deficit, disorientation, perceptual disturbance; American Psychiatric Association, 2022). However, such an unusual experiential depth is well-known from the spectrum of NDEs. Hence, some of these experiences might rather be regarded as instances of profoundly distressing NDEs in the classification of Lawrence (1995) rather than instances of mere delirium (for an overview on distressing NDEs, see Greyson, 2023; for an earlier monograph, see Bush, 2012).

Experiences according to which comatose patients were fully aware inside their body but unable to communicate or move in any way (Lawrence, 1995) continue to be reported as well (Kerkhoffs, 1994; Levy, 2015; Morales, 2008; Orange, 2014; Pearce & Pearce, 2024). Elsewhere, one of us (MN) has described the case of a woman in a hospice who unexpectedly woke up from a coma after two and a half months (Nahm, 2013). She had been transferred to the hospice from a hospital after an EEG recorded no cortical activity. Hence, she was considered to be entirely unconscious. Further attempts to monitor her brain via EEG

had not been performed in the hospice, however. After she awoke, it turned out that she had overheard emotional private conversations the caretakers shared between themselves at her bedside, being lucidly aware. She remained conscious and died about four months later. Similarly, the case of "Juan" described by Adrian Owen (2017) concerns a patient who awoke unexpectedly from a very deep coma. He had obviously been fully conscious even during the time his brain activities were examined twice by Owen's team in an fMRI scanner, and the scans showed no signs of coherent consciousness and cognition.

It is, in fact, known already for a long time that comatose patients can sometimes hear and understand what goes on around them. Hence, although systematic studies to assess this peculiar phenomenon are largely lacking, guidelines for coma patient care often include the recommendation that caregivers should behave as if the patients were conscious, e.g., by always talking as if the patients can hear and understand what is being said (Lawrence et al., 2023). However, as the above-described example of the comatose woman in the hospice shows, these recommendations are not always kept. This may in part be due to the assumption that the presence of a conscious mind requires intact cortical functions, as in instances of the medical condition known as the "locked-in syndrome." Here, a patient may be conscious but unable to respond to stimuli because of paralysis of all four limbs and the lower cranial nerves (Posner et al., 2019, p. 6).

The locked-in syndrome is typically caused by brainstem pathology, while cortical functions remain intact and functional (Das et al., 2024). But in case cortical functions are known to be severely impaired according to EEG recordings or brain scans, and it is furthermore expected that these functions will not improve again, one might infer that the patient is definitively unconscious and behave accordingly, thereby neglecting existing recommendations for coma patient care. However, there is growing evidence that unresponsive patients with severe brain injuries may perform cognitive tasks that are detectable via EEG and fMRI (Lawrence et al., 2023). A recent study detected such responses to cognitive tasks in 60 of 241 patients (25%) who were otherwise unable to show signs of cognition (Bodien et al., 2024). This confirms the findings mentioned earlier, according to which 25 to 40% of patients who had been in a nonresponsive state but recovered reported they were able to hear and understand what had been said at their bedside (Lawrence et al., 2023).

In any case, being lucidly aware inside a nonresponsive body can be deeply traumatizing for people in such a state on a general level. Because the entire field of coma experiences is under-researched, there is a pressing need to investigate the spectrum of the different kinds of coma experiences and to raise the awareness about them in order to improve important practical aspects of coma patient care (Lawrence et al., 2023; see also the online training course about experiences of unconscious patients for nurses, Lawrence, n.d.).

In the present publication, we provide a contribution to the study of coma experiences. We present the case of a coma patient who was lucidly aware throughout the 44 hours he spent in a medically induced coma after suffering acute oxygen starvation that already affected the brain stem. It concerns a previously healthy man of 33 years, Gil Avni. The coma was induced because he suffered a sudden respiratory failure of unknown origin that was thought to result in severe anoxic brain damage. However, Avni could recall the events that happened at his bedside with perfect accuracy. Being conscious but completely paralyzed throughout this time was a traumatizing experience for Avni. In order to refer to this state from the experiential first-person perspective, we term it a "locked-in experience." His case has already been covered in the extensive documentary film "44 Hours" that was produced by Einat-Hana Shamir and directed by Rotem Gross (Gross & Shamir, 2022). By presenting and discussing it in this paper, we follow two main aims:

1. We provide a review of Avni's locked-in experience, demonstrating that he retained his full lucid awareness and was able to memorize everything that occurred throughout his utterly precarious and seemingly unconscious state. We discuss the implications of his case for consciousness studies.
2. As a means to cope with his traumatic experience, Avni started to inform healthcare professionals and the public about what happened to him. His activities have already led to the adaptation and improvement of coma patient care in Israel. Assuming that other comatose patients who are considered to be unconscious might, in fact, be fully conscious, we hope that making his case better known also outside of Israel will raise awareness regarding the occurrence of such paradoxical states of consciousness and stimulate the adaptation of guidelines for the treatment of coma patients also in other countries.

Below, we provide a concise overview of Avni's case. First, we describe the events concerning his health crisis from an outside perspective. Thereafter, we describe these events from the inner subjective perspective as experienced and reported by Avni. Both perspectives are covered in the documentary on his case (Gross & Shamir, 2022), and we add some additional medical and experiential details not contained in this documentary. This chiefly concerns OBEs and spiritual elements of Avni's experience. Earlier, he was reluctant to share these episodes publicly because of the fear of being ridiculed. In accordance with this, and in order to achieve the maximum practical impact in the medical community, the team creating the documentary decided to focus on the fact that Avni was continuously conscious and not to include potentially distracting and controversial elements. In the Discussion section, we put Avni's experience in the context of other cases and highlight their implications for medical practice and consciousness research.

CASE REPORT

The External Course of Events

On the evening of Thursday, December 17, 2015, Gil Avni watched a sports event on TV at home in the living room. His two young children were sleeping already, and his wife, a hospital nurse by profession, went out for the evening at about 8:15 p.m. When she returned home at about 0:30 a.m., she found Avni on the sofa in front of the TV in an alarming condition. He was "cyanotic" (the skin had a bluish-purple hue due to prolonged deficient oxygenation of the red blood cells), had a respiratory rate of 50 breaths per minute, and slipped in and out of consciousness in a highly confused state. When emergency medical services arrived, the pulsoxymetrically measured oxygen saturation in his blood was determined to be around 50%, sometimes even lower (normal values are 95% or higher). Avni's pulse frequency oscillated between 180 and 200 beats per minute. He was put on a stretcher and immediately driven to the trauma room of a hospital. After arrival, his blood oxygen saturation was still 50%, and he was still cyanotic despite being ventilated with a bag valve mask. Again, he was confused, slipped in and out of consciousness, and was sometimes agitated. At one point, he threw up, and stomach acid entered his lungs. This complicated and hindered the oxygenation process, thus increasing the risk of brain damage due to prolonged severe oxygen deficiency. In order to sedate him and minimize the oxygen consumption of his brain, Avni was put into a medically induced coma. He received Propofol, Ultiva, and Dormicum and was then intubated with an endotracheal tube to ensure oxygen supply and put on ventilation. Nevertheless, his lungs started to develop aspiration pneumonia due to the inhaled vomit.

When the physicians checked Avni's eyes, they noted that one of his pupils was dilated and unresponsive to light stimuli, suggesting a neurological condition in the brain stem probably caused by mechanical compression. He was rushed to the CT scanner. The scans indicated the presence of cerebral edema, although its extent remained unclear. The oculocephalic reflex ("doll's eyes reflex") was negative, thus confirming severe brain stem dysfunction. The overall diagnosis of his brain state was "anoxic brain damage." After the scans, it remained impossible to stabilize Avni's condition. All treatments failed. His life was considered to be critically endangered by the attending physicians. One of them urged Avni's wife to call Avni's parents, as he suspected that he would not survive the next four hours until morning. However, she refused to call them, fearing that their fragile health would suffer too much when being woken up in the night with this kind of information.

When the Friday morning shift arrived, the situation was basically unchanged. The oxygen saturation of Avni's blood was only around 70%, and the pulse frequency was about 200 beats per minute. A vast array of treatments and medications had already been tested, but nothing had a positive effect on his condition. His brain was considered to be irreversibly damaged.

In the meantime, his wife had called and informed his parents about their son's state of health. Soon after, in the morning, visits of people who came to say their last goodbye to Avni commenced. All in all, 17 visitors arrived. Apart from his wife and parents, they included his sister as well as other relatives, friends, and colleagues from work. It was the general consensus that it would be unlikely that he survived his malady – and that if he survived, he would not be the same person anymore because of the suspected brain damage that most likely had already been occurring.

A few hours later in the evening, Avni's body started to move and shake in a seemingly spastic manner. As a result, the medical devices he was hooked to went into alarm mode and started beeping. The ICU nurse in charge became very nervous, shouted "We are losing him!" and called for a physician. They decided to increase the amount of anesthetics to prevent further spastic movements and immobilize Avni's muscles.

On Saturday morning, his parents and wife visited him again in the hospital. His father-in-law and brother-in-law came as well. Avni's condition had not changed much. Later in the afternoon, a physician checked his eyes and noted that one pupil was still dilated. However, two attending physicians had different opinions concerning his state. One physician thought that it was too early to conclude that Avni would be retarded or in a vegetative state if he continued to live. The other physician thought it was virtually certain that he must have severe brain damage by now and that they should wait another 72 hours and then try to wake him up to determine the degree of this damage. Participating in this discussion at Avni's bedside, his wife realized that tears ran from his eyes. She concluded that he must be listening to this discussion as well.

As a result, it was later decided that the night shift personnel would try to wake him up after his wife and parents left. In the evening, the anesthetic medication was therefore decreased, and Avni was repeatedly asked to move his eyes. At one point, the Senior ICU nurse indeed noticed a slight movement of his pupils that followed her instructions. The procedure to wake Avni up was continued. Not long after, he woke up completely, and to the surprise of everybody, all critical symptoms, including pulse and blood pressure, rapidly returned to normal. In order to facilitate communication with him (he was still weak and intubated), the nurse handed him a letter board as well as sheets of paper and a pen. One of the first things Avni communicated was: "I was in full consciousness since Thursday evening. I heard everything they said, word for word."

On Sunday morning, the endotracheal tube and other medical devices were removed. Soon after, Avni left the hospital on his own account. To this day, none of the physicians and ICU nurses involved in Avni's case has a medical explanation for his sudden and dramatic life-threatening breakdown – much less for his prompt recovery to full health. Only the aspiration pneumonia improved comparably slowly. It took three months until Avni's lungs were healthy again.

The Personal Experience of These Events by Gil Avni

The most intriguing aspect of this episode, however, is Avni's personal experience of these events. The last thing he remembers from being at home is that he was watching a commercial break on the TV in his living room. He became particularly intrigued by an advertisement for a TV film about doctors; it seemed like a documentary: Four people were running frantically with a man on a stretcher through the floors of a hospital towards a room. Avni heard no sounds but perceived the scenery only visually. The doors were open, and other people were already waiting for this man to arrive. On the right side of this room lay another man who was apparently in a bad state of health. The man on the stretcher was then surrounded by people. Two doctors now stood over him. Suddenly, Avni recognized that this man was wearing his (Avni's) trousers. He concluded that the man who had been rushed into this emergency room on the stretcher must, therefore, be himself. Once he realized this, the perspective shifted, and he was also able to hear again. Avni saw these two doctors now from an embodied perspective, leaning over him and facing him. He realized that the medical staff around him was in complete panic. He also felt a strong pressure in his chest region, and he then threw up, smudging one of the two doctors. Thereafter, Avni was anesthetized and intubated. One doctor shut and glued his eyelids to save the cornea from dehydration. From then on, he followed the events that occurred during the next two days chiefly via his sense of hearing from this in-the-body perspective, although he also experienced occasional OBEs again, during which he seemed to perceive his environment visually.

Typically, Avni entered the OBE-state in particularly distressing and emotionally intense situations. This happened, for example, when the visitors came to say their goodbyes. In this situation, he was able to perceive them visually and memorize the clothes they wore. He even saw his sister, who had to wait in a corridor of the hospital about 30 to 40m from his room. She was not allowed to visit Avni at his bedside because she was pregnant and he was treated with nitric oxide, a substance that may cause harm to developing fetuses. Still, Avni saw her (crying) and followed the conversations she led, e.g., with her husband, and was later able to describe her clothing. In discussions with Avni, his sister, and other visitors, members of the team producing the documentary were able to corroborate that he had described the events that occurred accurately and gave correct descriptions of their clothes (of the authors of this article, the team members include E.-H. S. and S. A. K.).

Other elements that link his case to NDEs include the perception of an attractive, bright, whitish light. He perceived it in the OBE state in the distance when he was initially transported through the hospital corridors into the room where he was to be put into the coma. But Avni did not want to get closer to this light. Moreover, he felt the

distinct presence of a spiritual entity throughout the entire time he was in the coma. When he was in the OBE state, he could even perceive it as a shadow-like figure inside his room. Apparently, this entity was already present when he arrived in the hospital room and stayed with him until the decision was made to wake him up from the coma. Throughout that time, it encouraged Avni to stay alert and awake, and not to give up hope for recovery. According to Avni, who regards this entity as a kind of guardian angel, it approached him and touched him with a finger after the decision to wake him up was made. This touch felt like a tremendous jolt of electricity-like energy, and the being informed him that it was now time to leave him because its duty was fulfilled.

In any case, throughout the entire time Avni was thought to be unaware, he remained fully conscious. He followed and remembered everything that happened around him. That included every conversation held in the vicinity of his bed by anesthesiologists, neurologists, nurses, family members, friends, etc. He even heard and remembered the squeaking sound of the bed on which he was transported to the CT scanner. When he heard the doctors discussing his suspected cerebral edema and the potential brain damage, he tried to intervene, stressing that his mind was fully intact, but he could not let them know.

Not knowing what had actually happened and how he arrived in this situation, Avni realized that it would be very important to remember everything that had been said next to him. He started to purposefully memorize everything, all that he heard. He is convinced that this purposeful memorizing of all acoustic perceptions is one factor that kept him together and helped him to stand this utterly horrible experience. As demonstrated in the documentary film, Avni was very successful in memorizing what happened and what had been said. He accurately remembered virtually everything that the various doctors and nurses said in their different shifts, be it addressed to him or at each other. He was greatly relieved when he heard how and why he arrived in his present situation when the Thursday night shift informed their successors on Friday morning about what happened to this patient. Only then did Avni learn that he had collapsed on the sofa at home while watching TV, that his wife had found him, and that he had been rushed to the hospital with emergency medical services. Moreover, he remembered everything that the numerous visitors who came to bid him a last farewell spoke at his bedside.

A particularly important episode occurred on Friday evening, the second day he was unconscious. For some reason, Avni suddenly sensed a tingling feeling in one of his feet. He decided to take all his forces together in order to kick with this leg to demonstrate to the attending ICU nurse that he was awake inside, not unconscious. Although Avni was not feeling his entire body, he still had the impression that he was kicking successfully with his leg. Indeed, the nurse noticed movements – not only in his leg but all over Avni's body. As described earlier, the medical devices he was connected to went into alarm mode, the nurse became extremely nervous and shouted, "We are losing him!" This unexpected stressful development of the events greatly alarmed Avni himself, which led to another brief OBE during which he could perceive his environment, including the nurse, the monitors of the medical apparatuses, and the physician entering his room. However, his consciousness soon slipped into the body again, and he was only able to follow what happened acoustically. Avni overheard the conversation between the nurse and the physician, who then increased the anesthetic medication in order to avoid further spastic movements. Within 10 seconds, the slight tingling sensation Avni felt in his foot disappeared. This failure to alert the nurse's attention regarding his true state and the renewed loss of any capacity to move his body was one of the most desperate episodes during his time of supposed unconsciousness.

Similarly, when the nurse tried to wake Avni up and he did not succeed in moving his eyes at first, he became desperate. As soon as he was finally able to communicate, he was immensely relieved and urgently longed to talk about his experiences, informing people he was OK and that he had been fully conscious all the time. This is why he immediately wrote about his experience after the nurse gave him the papers and the pen.

Figure 1 shows a timeline depicting important events that occurred from Thursday evening, when Avni suffered his respiratory failure, to Sunday morning, when he left the hospital again.

All in all, these experiences had been utterly traumatic for Avni. He virtually felt trapped inside his body and feared that, in the worst case, he would have to spend a very long time, perhaps years or the rest of his life, in this unbearable state of existence. For several months after he recovered, Avni had nightmares, sometimes each night, waking up screaming and sweating profusely. Because he was afraid of returning back into a state in which his body was "sleeping" while his mind was fully awake, he feared falling

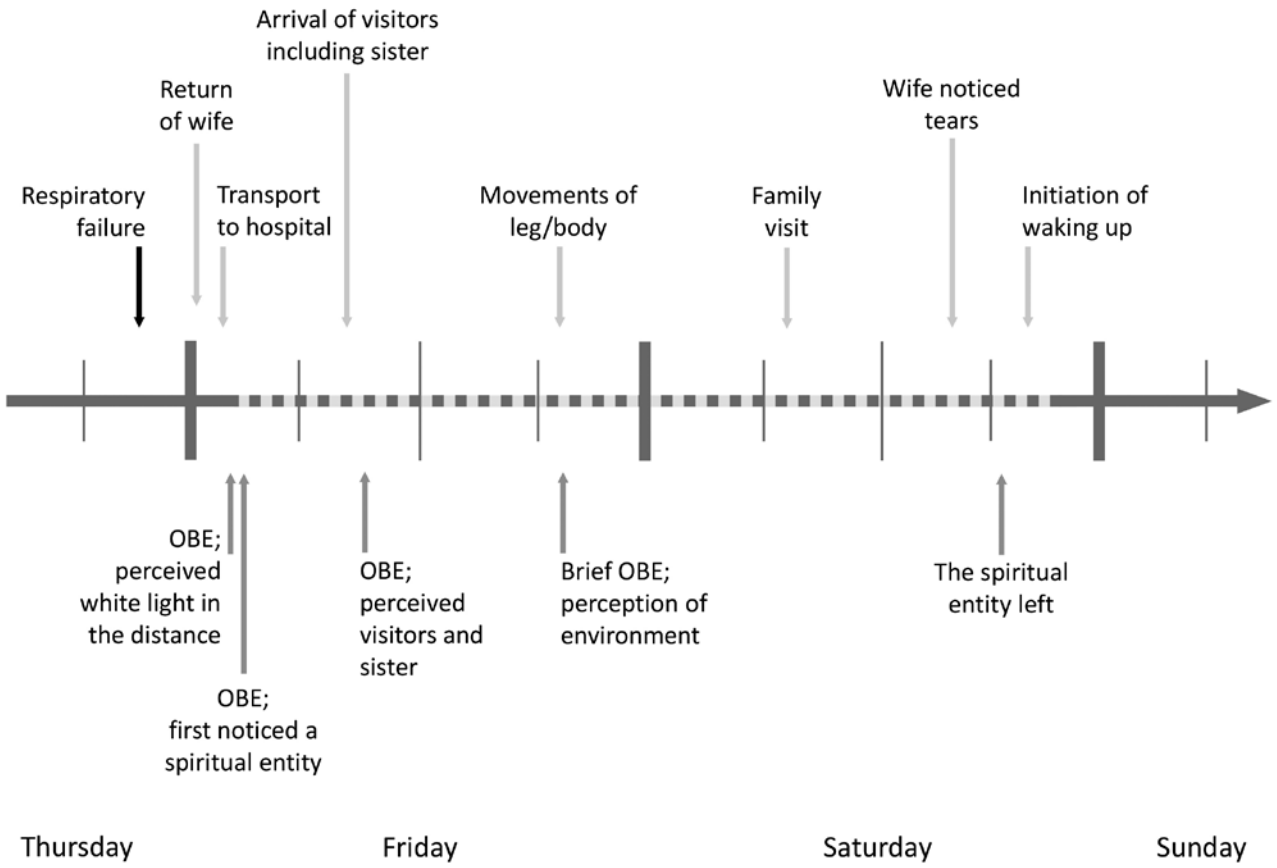

Figure 1. Graphical illustration of important events along the timeline of Gil Avni's coma experience. The time span shown runs from Thursday evening (December 17, 2015) until Sunday morning. Days are separated by thick gray vertical lines. The thin gray vertical lines indicate time intervals of six hours, the longer ones representing noon. The dotted area within the horizontal line indicates the time Avni spent in a coma, but was fully conscious. The occurrences of externally observable events are depicted above this line; personal experiences of Avni are depicted below it.

asleep at night. As a result, Avni barely slept for two years. Similarly, he feared that a similar incident of unexplained respiratory failure might happen again. Episodes in which he is emotionally troubled by his locked-in experience still come and go.

For Avni, one way to cope with this distressing coma experience consisted of informing other people about it, trying to raise awareness of such occurrences in order to help others who might be in a similar situation. He considers this activity and attempts to help others to be part of his recovery process. Even today, Avni remembers the events that occurred during the 44 hours he spent in this coma with vivid clarity. However, he did not have noteworthy or clear memories concerning the events that occurred in his living room at home, during which he seemed to be confused and agitated, slipping in and out of consciousness. Regarding the first occurrences in the hospital, Avni only remembers observing the events from a detached external perspective, watching the physicians working on an apparently sick and confused patient whom he did not even identify as himself.

DISCUSSION

The case of Gil Avni is remarkable for a number of reasons. Because the producers of the documentary movie interviewed numerous witnesses, it was possible to positively ascertain that he indeed remembered everything that happened in the course of his 44-hour-long coma correctly. In addition to the medical personnel of the changing shift teams in the hospital, many of the 17 private visitors at his bedside confirmed that what Avni reported about the conversations and occurrences in the hospital was perfectly accurate, including his description of the clothes they wore. He was conscious and lived through a terrifying locked-in experience when everybody thought his brain condition

would definitively exclude this possibility. In addition to the suspected cerebral edema that was thought to have caused irreversible anoxic damage of his cortical functions and the brain stem, Avni was put into an induced coma to minimize his brain's activities and oxygen consumption. When brain activities during medically induced comas are monitored via EEGs, they typically display a pattern known as "burst suppression" (San-juan et al., 2010; Shanker et al., 2021). This pattern is considered to be an indicator of extremely low brain activity, and it is generally assumed that it is impossible to be continuously and coherently conscious when the brain shows this activity pattern. In very deep induced comas, the cortical brain regions can become even less active and display an isoelectric "flatline" in EEG recordings. It would be very interesting to know what EEG patterns Avni's brain displayed during his coma, but EEG measures had not been employed in his case.

However, as a result of discussions with Avni and his activities to raise awareness regarding such locked-in experiences in comas in order to reduce the frequency of their occurrence in the future, the medical staff of several hospitals in Israel has revised and adapted their practices for coma patient care. Many nurses have, in fact, been eager to improve and change aspects of their work after having followed a mere routine for years. This includes the recommendation that brain activities of comatose patients in ICU rooms are monitored via EEG devices. Should their recordings show signs of brain activity indicative of consciousness, the medical staff should initiate attempts to wake patients up. Some hospitals in Israel have already installed EEGs in ICU rooms. The improvements of previous practices for coma patient care for physicians and nurses in ICU rooms furthermore include the following:

- When handling comatose patients, they must be addressed in person and by their first name.
- Add a photo of the comatose patient from a time they were healthy to the medical map in order to remember that this unresponsive person is an individual with a colorful life history and social relations.
- The medical team must not make casual remarks on the patient's health or discuss the patient's condition between themselves and with visitors at the patient's bed.
- Nevertheless, medical diagnoses are carefully explained and actively shared with patients.
- Medical teams inform and update the patients' families regarding their condition and medical procedures in a neutral setting, not at the patients' beds.
- Depending on the individual condition of the patients, attempts to wake anesthetized patients up are made more frequently than before, ideally every four hours.
- Hospital staff and visitors must not hold private conversations about personal matters next to patients in ICU rooms.
- The limbs of anesthetized and ventilated patients are not to be fixed to their beds.

Recommendations for visitors of patients include the following:

- Convey hope and a positive atmosphere around the patient.
- Play music the patient likes.
- Inform the patient about topics of their interest (hobbies, sports, leisure activities) and update them regarding current events (family, friends, business).
- Bring the patient scents related to their home or loved ones (a beloved dog's collar, a significant other's perfume or cologne, their mother's cooking, etc.).
- If appropriate, try alternative treatment methods such as guided meditation.

These improvements are merely performed by hospital staff in Israel as a result of being familiar with Gil's case. They have not yet found their way in printed versions of coma care guidelines. Therefore, we recommend including these improvements in printed guidelines and literature on coma patient care in Israel and other countries.

A further recommendation is to regularly move the body or limbs of seemingly unconscious patients since sensory stimulation of this kind might increase their awareness (Lawrence et al., 2023) or help them to show signs of awareness by subtly reacting while being moved. For the nurse who awoke Avni from his coma, slight resistance to bodily movements provided an indication that Avni might indeed be conscious.

It is also important to apply these improved practice methods not only to patients in medically induced comas, but also to patients who slipped into a nonresponsive state because of fatal diseases and natural causes such as accidents, cardiac arrest, or suffocation (e.g., Levy, 2015; Morales, 2008; Orange, 2014). For example, we know of another case in Israel in which somebody suffocated due to

a natural cause and seemingly fell unconscious. However, also this person, at that time a 13-year-old boy, remained fully conscious and followed everything that happened on his way to the hospital and in the hospital acoustically from an in-the-body perspective. When he arrived there, his heart had already stopped beating, and his skin was cyanotic. A physician performed a tracheostomy, and he was finally resuscitated. Also, for this boy, being lucidly awake throughout this time inside a nonresponsive body was an utterly traumatic experience. Today, he is a retired professor. His locked-in experience occurred 66 years ago, and he still remembers it very vividly and intensely.

From the related context of studies into NDEs, it is in fact well established that people who appear to be unconscious for whatever reason can still be conscious and live through profound and often life-changing experiences. Although NDErs more typically report having observed the occurrences from an out-of-the-body perspective rather than from an inside perspective, these experiences can dramatically impact those who experience them. But because Avni's experience also included OBEs and spiritual elements, just as in more typical NDEs, the following example of an NDE resembles Avni's case in important respects (Sartori, 2008; Sartori et al., 2006): A 60-year-old patient collapsed in a hospital. His oxygen saturation dropped, he was ventilated with an Ambu bag, and a light that a physician shone into his eyes showed that the pupils reacted unevenly, one was larger. After more efforts to save and stabilize the patient, he regained consciousness about three hours after his collapse. As soon as he could, he excitedly tried to communicate something to the physicians, but could not do so because he was still being ventilated. As in Avni's case, he was given a letter board. He spelled out: "I died and I watched it all from above." Due to his OBE, he was furthermore able to provide veridical descriptions of occurrences that happened around his bedside during the time he had seemingly been unconscious.

In numerous other cases, patients provided similar veridical descriptions of occurrences around their bedside even after their hearts had stopped beating, sometimes for more than ten minutes (Holden, 2009; Rivas et al., 2023; van Lommel et al., 2001). However, according to current models of brain functioning, perceiving the environment and remembering everything correctly should not be possible under conditions of severe oxygen deprivation and brain malfunctioning. Several authors, therefore, suggested that in such cases, these experiences did not take place in real-time. Rather, they would be a reconstruction in which stimuli subconsciously received in the past had been amalgamated into a hallucination-like OBE during the time when the patients' brains were already recovering again. The impression that these OBEs and NDEs had been made in real-time would be erroneous (e.g., Marsh, 2010; Mitchell-Yellin & Fischer, 2014). For a number of reasons, however, this neurophysiological reconstruction model is faced with conceptual difficulties and empirical evidence that contradicts some of its corollaries (Nahm & Weibel, 2020).

In this context, the case of Gil Avni also contributes to the theoretical aspects of consciousness studies. It is well established that he followed the events in his surroundings in real-time during his coma, at times even from an OBE-perspective. This is evidenced by his virtually unbroken chain of exact and correct memories concerning the events and conversations held by numerous people at his bedside during the course of 44 hours. His experience furthermore contains objective markers that were observable from an external perspective: His description of the events and conversations surrounding the successful movement of his leg (in fact, body) and the subsequent increase of anesthetic medication perfectly matches the corresponding account of the attending medical staff. Likewise, he cried tears when following the discussion of physicians and his wife about his condition, which they held at his bedside.

Moreover, Avni seemingly never lost consciousness during his coma and remained on a high level of lucid awareness continuously, even during the phase when he was woken up. He remembered the entire procedure and the words that the responsible nurse said during its course. It seems that neither the amount of decreasing anesthetic medication nor that of increasing oxygen in his blood had an impact on Avni's mental state. In sum, there is no indication that his locked-in experience was a hallucination-like construct that was created at the time his brain slowly regained its function as he woke up from an unconscious state, as it is postulated in the neurophysiological reconstruction model. Rather, it is fairly obvious that his experience took place in real time. Much the same applies to the case of the 13-year-old boy described above and "Juan", the comatose patient whose brain activities were studied by Owen (2017) and found to be essentially nonfunctional.

But in contrast to the latter two cases and numerous other reported coma experiences (Lawrence, 1995; Pearce & Pearce, 2024), it is of added interest that Avni's coma

experience contained the already mentioned occasional OBEs and other typical elements reported from NDEs. This overlap of coma experiences and NDEs demonstrates the variability of experiences made in near-death states and thus, the significance of Avni's case for NDE research. His experience provides one more example highlighting that individual case studies can contribute in important ways to advancing our knowledge about the relation of the mind and the brain, or more specifically, about brain conditions under which it is still possible to be lucidly aware (for other examples, see Rivas et al., 2023).

One reason why advancing this knowledge is important concerns the practice of organ donation. Before organs can be explanted from comatose patients, the patients need to be declared "brain dead." Such declarations are obviously a delicate matter and require standardized regulations. But given that there is already a wide heterogeneity among healthcare professionals regarding the clinical definition, diagnosis, and management practices regarding coma (Helbok et al., 2022), it is not surprising that also criteria and practices regarding organ donation differ in different countries and ethical implications of organ donation are discussed controversially (van Veen et al., 2018; Klessig, 2023; Shewmon, 2024). Moreover, the factual practice in hospitals may differ from theoretically prescribed procedures, leading to misdiagnosis (Beckmann, 2023). In fact, there have been numerous comatose patients who recovered after having been considered "brain dead" (Respect for Human Life, 2022) – and to their horror, some of them had even been conscious when the doctors discussed organ donation or the termination of life support at their bedsides (Levy, 2015; Morales, 2008; Orange, 2014). Similarly, it was assumed by some that Avni's brain might be "dead" or dying. His wife, then a hospital nurse familiar with critical patient care, expected that the organ transplant manager would approach her any time to discuss the possibility of organ donation regarding her husband. To her relief, this did not happen. The brains of "brain dead" patients who regained consciousness had obviously not been dead. These patients only had a severe brain failure.

But to learn more about the brain conditions during which it is still possible to be aware, there is an urgent need to perform prospective large-scale studies on coma experiences, also from this perspective. If 25 to 40% of unresponsive patients can show evidence for the performance of cognitive tasks in response to respective requests (Bodien et al., 2024) because they are able to hear (Lawrence et al., 2023), many more unresponsive patients than presently assumed might, in fact, be conscious. Until today, however, the enormous implications for organ donation of lucid awareness, even in unresponsive patients whose brains are deemed to be severely and irreversibly damaged, are barely discussed in the literature on NDEs, coma, or organ donation itself. There are only a few exceptions (van Lommel, 2011; Nahm, 2013).

To conclude, we believe that the case of Avni is important for several reasons:

On a general and theoretical level, Avni's case contributes to advancing our understanding of theoretical models of NDEs because it constitutes one more example that questions the plausibility of the neurophysiological reconstruction model for NDEs and provides added evidence for real-time models.

On the practical level, it contributes to raising awareness about the possibility that comatose patients might be conscious even when the prevailing brain conditions make it seem quite unlikely. Because locked-in experiences can be utterly traumatic for coma patients, recognizing the possibility of what may be called "paradoxical awareness" in comas when brain functions are severely compromised is important in at least three respects:

- It demonstrates the need to revise and improve practical aspects of contemporary coma patient care, as already evidenced by the adaptions of the nursing practices achieved in Israel.
- It demonstrates the need for systematic research into coma states, specifically regarding coma experiences (including "ICU delirium") and their aftereffects in the context of induced comas.
- It demonstrates the need for systematic research into states of unresponsiveness that resulted from diseases and natural causes, including suffocation, cardiac arrest, and accidents, also for advancing the medical and ethical foundations of organ donation.

Such studies could be performed along the lines described in Lawrence et al. (2023). In addition to electrophysiological methods to detect awareness, interviews with previously unconscious patients are highly desirable. The potentially veridical perception of events or targets in the physical environment from an OBE-perspective (Parnia et al., 2023) could be included as a partial research objective as well.

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