Objectives:

Near-Death Experiences (NDEs) are classically associated with positive emotions like peacefulness, happiness and joy [3]. To date, few patients with LIS have been documented [4]. Although NDEs classically arise in the context of an acute severe brain damage, their associated memories are reported as being phenomenologically very rich and detailed [5]. To date, no satisfactory explanatory model exits to fully account for the rich phenomenology of NDEs following a severe acute brain injury [6]. Neurobiological hypotheses include cerebral hypoxia [7, 8] and temporal lobe dysfunctions [9] to account for some of the features occurring during NDEs. However, it has been recently shown that anoxic/hypoxic, traumatic and other supratentorial brain lesions do not seem to influence the content of a NDE when assessed with a standardized tool (i.e., Greyson NDE scale; [1]). Due to their particular brain lesion (i.e., pontine brainstem), locked-in syndrome (US) patients provide a unique opportunity to further investigate the neural correlates of NDEs.

We here aimed at retrospectively characterizing the content of NDEs in patients with US having suffered from an acute brainstem lesion (cerebrovascular accident (CVA) or trauma; i.e., “US NDEs”) and to compare these experiences to those collected in a cohort of matched NDE experimenters after coma with supratentorial lesions (CVA or trauma; i.e., “classical NDEs”).

Methods:

In collaboration with the French Association for Locked-In Syndrome (US) (http://all-assos.fr), patients with US who retrospectively recalled memories from their coma period were referred to our research team and invited to fill in a structured questionnaire, aided by a proxy. The questionnaire included demographic and clinical information (age, gender, duration and etiology of US) and the Greyson NDE scale [10]. The scale consists of a validated 16-item multiple-choice tool (i.e., scores ranging from 0 to 32) used to characterize the experience’s content (items’ associated 16 NDE core features) [10]. For each item, the scores are arranged on an ordinal scale ranging from 0 to 2 (i.e., 0 = “not present”, 1 = “mildly or ambiguously present” and 2 = “definitively present” [10]). For statistical analyses, a feature was considered present when participants scored an item as 1 or 2. Patients with US whose experience did not meet the accepted criteria of NDE (i.e., Greyson score total 27; [10]) were excluded from further analyses.

Differences between “US NDEs” and “classical NDEs” groups were assessed using Student’s t-test (age and time since insult) and a Pearson’s chi square test (gender, etiology and Greyson NDE scale items) using SPSS (Statistical Package for the Social Sciences, version 22.0, SPSS Inc., Chicago, IL, USA). Results were considered to be significant at the 5% critical level (p<0.05) and were expressed as mean ± standard deviation (SD) for quantitative variables and as counts and proportions (%) for categorical variables.

In this study, we excluded patients with US who experienced paranoia and joy and the increased frequency of autobiographical life review could be related to an altered connectivity in [paralimbic systems secondary to the acute pontine brainstem dysfunction [12], similar to what can be observed in REM sleep intrusions and nightmares [3, 13]. Some authors have indeed postulated that positive emotions and autobiographical memory flashes in NDEs could be linked to mesiotemporal dysfunction (involving amygdala and hippocampus) [6]. The presence of “life review”, usually one of the least reported features by NDE experiencers [3-5], was here reported in 68 patients with US. It could be hypothesized that the specific ventral pontine brainstem lesions causing the US and their potential repercussion on afferent and efferent pathway with (paralimbic/midbrain structures and neurotransmitters systems [3, 14] could account for the observed differences in NDEs content. Thus, when brain lesions occur at the infratentorial level, individuals might experience more negative emotions and memory flashbacks. Alternatively, it could be argued that finding oneself in a paralyzed body might account for the positive potential and possibly frightening emotions associated with the experience. A parallel could be drawn to the pharmacologically induced Lucid dream that may be encountered in general anesthesia when patients receive muscle relaxants together with inadequate amounts of anesthetic drugs. Further studies should disentangle whether negative NDEs have a specific neuroanatomical substrate (i.e., could be related to an altered limbic/pontine connectivity) or should be seen in the light of the specific emotional distress caused by motor paralysis and residual conscious awareness.

Results:

14 patients with US recalled having had memories of their coma period. 8 (57%) qualified as a NDE according to the Greyson NDE scale criteria (i.e., total score ≥7) [10]. Table 1 reports the demographic information of the “US NDEs” and “classical NDEs”.

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Conclusion & discussion:

We here report that patients with NDEs following an acute brainstem lesion and subsequent LIS, less frequently recount positive emotions and more frequently experience autobiographical memory flashbacks. The lower proportion of patients with US experiencing peacefulness and joy and the increased frequency of autobiographical life review could be related to an altered connectivity in [paralimbic systems secondary to the acute pontine brainstem dysfunction [12], similar to what can be observed in REM sleep intrusions and nightmares [3, 13]. Some authors have indeed postulated that positive emotions and autobiographical memory flashes in NDEs could be linked to mesiotemporal dysfunction (involving amygdala and hippocampus) [6]. The presence of “life review”, usually one of the least reported features by NDE experiencers [3-5], was here reported in 68 patients with US. It could be hypothesized that the specific ventral pontine brainstem lesions causing the US and their potential repercussion on afferent and efferent pathways with (paralimbic/midbrain structures and neurotransmitters systems [3, 14] could account for the observed differences in NDEs content. Thus, when brain lesions occur at the infratentorial level, individuals might experience more negative emotions and memory flashbacks. Alternatively, it could be argued that finding oneself in a paralyzed body might account for the positive potential and possibly frightening emotions associated with the experience. A parallel could be drawn to the pharmacologically induced Lucid dream that may be encountered in general anesthesia when patients receive muscle relaxants together with inadequate amounts of anesthetic drugs. Further studies should disentangle whether negative NDEs have a specific neuroanatomical substrate (i.e., could be related to an altered limbic/pontine connectivity) or should be seen in the light of the specific emotional distress caused by motor paralysis and residual conscious awareness.

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<tr>
<th>US NDEs</th>
<th>Classical NDEs</th>
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<tr>
<td>Gender-female</td>
<td>5 (33)</td>
</tr>
<tr>
<td>Age at NDE (Mean in years)</td>
<td>31 ± 6</td>
</tr>
<tr>
<td>Time since NDE (Mean in years)</td>
<td>19 ± 9</td>
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Frequency of reported Greyson scale items in patients with locked-in syndrome (US; n=18) and matched “classical” NDEs after coma (n=23). *p<0.05; **p<0.001.

References: