S. Laureys et al. (Eds.)
Progress in Brain Research, Vol. 177
ISSN 0079-6123

CHAPTER 23

Life can be worth living in locked-in syndrome

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Abstract: The locked-in syndrome (LIS) describes patients who are awake and conscious but severely deefferented leaving the patient in a state of almost complete immobility and loss of verbal communication. The etiology ranges from acute (e.g., brainstem stroke, which is the most frequent cause of LIS) to chronic causes (e.g., amyotrophic lateral sclerosis; ALS). In this article we review and present new data on the psychosocial adjustment to LIS. We refer to quality of life (QoL) and the degree of depressive symptoms as a measure of psychosocial adjustment. Various studies suggest that despite their extreme motor impairment, a significant number of LIS patients maintain a good QoL that seems unrelated to their state of physical functioning. Likewise, depression is not predicted by the physical state of the patients. A successful psychological adjustment to the disease was shown to be related to problem-oriented coping strategies, like seeking for information, and emotional coping strategies like denial — the latter may, nevertheless, vary with disease stage. Perceived social support seems to be the strongest predictor of psychosocial adjustment. QoL in LIS patients is often in the same range as in age-matched healthy individuals. Interestingly, there is evidence that significant others, like primary caregivers or spouses, rate LIS patients' QoL significantly lower than the patients themselves. With regard to depressed mood, ALS patients without symptoms focus significantly more often on internal factors that can be retained in the course of the disease contrary to patients with depressive symptoms who preferably name external factors as very important, such as health, which will degrade in the course of the disease. Typically, ALS patients with a higher degree of depressive symptoms experience significantly less "very pleasant" situations. The herein presented data strongly question the assumption among doctors, health-care workers, lay persons, and politicians that severe motor disability necessarily is intolerable and leads to end-of-life decisions or euthanasia. Existing evidence supports that biased clinicians provide less-aggressive medical treatment in LIS patients. Thus, psychological treatment for depression, effective strategies for coping with the disease, and support concerning the maintenance of the social network are needed to cope with the disease. Novel communication devices and assistive technology now offers an increasing number of LIS patients to resume a meaningful life and an active role in society.

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DOI: 10.1016/S0079-6123(09)17723-3

keywords: quality of life; depression; locked-in syndrome (LIS); amyotrophic lateral sclerosis; brainstem stroke; euthanasia; end-of-life

Introduction

The term locked-in syndrome (LIS) was first introduced by Plum and Posner in 1983 and describes patients who are awake and conscious but selectively deefferented, that is, have no means of producing speech, limb or facial movements. The American Congress of Rehabilitation Medicine (1995) defined LIS as a neurological impairment characterized by the presence of sustained eye opening (bilateral ptosis should be ruled out as a complicating factor), quadriplegia or quadriparesis, aphonia or severe hypophonia, preserved cognitive function, and a primary and elementary code of communication that use eye movement or blinking. The LIS can be subcategorized according to the severity of the motor impairment in: (1) *classical* LIS, characterized by quadriplegia and aphonia with preserved consciousness and vertical eye movements or blinking; (2) *incomplete* LIS, characterized by remnants of voluntary motion other than vertical eye movements; and (3) *total* LIS, characterized by complete immobility (including eye movements) with preserved consciousness (Bauer et al., 1979). Acute pontine lesions following vascular pathology are its most common cause (Plum and Posner, 1983; Laureys et al., 2005). LIS can also be observed in progressive neurologic pathologies like end-stage amyotrophic lateral sclerosis (ALS) (Ludolph and Dengler, 1999). It has been traditionally stated that long-term survival in LIS is rare (Ohry, 1990). Mortality is indeed high in acute LIS of vascular origin (87% within the first 4 months; Patterson and Grabois, 1986) and mean survival rate in ALS is 3–5 years with only a short period of time in LIS (Ludolph and Dengler, 1999). However, individuals in LIS may survive for long periods of time, sometimes exceeding 20 years (Doble et al., 2003; León-Carrión et al., 2002; Laureys et al., 2005). Doble et al. (2003) reported a 10-year survival of 83% and 20-year survival of 40% in 29 stabilized (i.e., surviving more than 1 year) LIS patients. Data from the French Association for Locked-In Syndrome (ALIS; www.alis-asso.fr) on 250 patients showed that mean time spent in LIS was 6 ± 4 years (range 14 days–27 years; Laureys et al., 2005). With improving medical technology, life with severe physical impairment can be significantly prolonged — for example, by application of noninvasive and invasive ventilation in ALS. Noninvasive ventilation prolongs life for 250 up to 300 days and has therefore the same life-prolonging effect as Riluzole, the only approved drug in ALS (Bourke et al., 2006). However, motor recovery is futile in a progressive motor neuron disease like ALS and the hope for motor recovery is limited in LIS of vascular origin (Doble et al., 2003). Despite the severe persisting motor deficits in classic LIS, some patients may present improvement (classically showing a distal to proximal progression) and recover voluntary control of head, finger, or foot (Richard et al., 1995; Laureys et al., 2005). Overall, the level of care remains extensive in chronic LIS and patients classically remain dependent on others for activities of daily living.

Autonomy and physical functioning has long been seen as the prerequisite of a life worth living (Chin et al., 1999). In recent years this was adjusted and life was defined to be worth living if there was a perspective of gaining autonomy (e.g., Bruno et al., 2008a, b). Studies show that QoL often equates with social rather than physical interaction or autonomy (Laureys et al., 2005). The arising question from our definition of ''a life worth living'' is what the consequences are for people with such extreme motor impairment, in which the probability for regaining autonomy in daily life is very limited. We may have to revise our classical idea of autonomy emphasizing that *mental* autonomy can be maintained even in a state of high dependence on others, in which much if not all physical autonomy is lost. The present work will review the available literature and present new

data on psychological adjustment of patients with severe states of motor impairment leading a life depending on others — including both LIS following an acute brainstem lesion and following chronic motor neuron diseases such as ALS.

Quality of life

Successful adjustment to a diagnosis can be measured as a degree of quality of life (QoL). According to the World Health Organization (WHO) ''quality of life is defined as the individual's perception of their position in life. (…) It is a broad ranging concept affected in a complex way by a person's physical health, psychological state, level of independence and their relationship to salient features of their environment'' (The WHOQOL Group, 1995). In the field of neurology and neuro-critical care, QoL has only been studied relatively recently. Communication limitations make QoL assessments in LIS patients particularly difficult (Murrell, 1999). Additionally, QoL measures may not be sensitive enough to capture specific issues relating to the disease. This seems especially true for patients with a LIS. A common approach to refining the concept of QoL is to restrict its definition to health-related QoL. The common understanding of a good QoL implies being in good health and experiencing subjective well-being and life satisfaction (Goode, 1994). According to this concept, LIS patients could not have a high QoL due to their low level of physical functioning. In reality, patients' perceptions of personal health, well-being, and life satisfaction are often discordant with their objective health status and disability (Albrecht and Higgins, 1977; Albrecht, 1994). Accordingly, LIS patients report a QoL often comparable to age-matched healthy controls and other chronically ill patients without severe motor impairment (Kübler et al., 2005; Rabkin et al., 2000; Lulé et al., 2008; Laureys et al., 2005). The self-reported subjectively experienced QoL of LIS patients with ALS is neither associated with physical functioning nor can it be predicted by this factor (Kübler et al., 2005; Lulé et al., 2008; Matuz et al., submitted). Notably, with the progression of the disease, patients with higher physical restrictions indicated a higher QoL than patients who were less impaired (Lulé et al., 2008).

We here report unpublished data on QoL measured in 30 ALS patients by means of the Schedule for the Evaluation of Individual Quality of Life Direct Weighting (SEIQoL-DW; Hickey et al., 1996) and the seiquol index score (SIS). Patients' age ranged from 37 to 72 years (mean 58 ± 8.9 years; 16 females). Physical restrictions were measured with the ALS functional rating scale revised form (ALS-FRS; Cedarbaum et al., 1999). We observed that QoL was *better* in patients with more severe motor impairment (Pearson correlation $r_{part} = -0.43$; $p < 0.05$, corrected for age). This correlation could be attributed to artificial ventilation: ALS patients who were on artificial ventilation (either noninvasive or invasive; $n = 13$) experienced a higher QoL compared to patients without ventilation ($n = 17$) (mean SIS $= 77.4 \pm 18.0$ SD versus 64.2 ± 14.8; univariate ANOVA with age as covariate, $F_{1/27} = 5.0$, $p < 0.05$; Zickler, unpublished). Note that a SIS of 77 is in the range of results obtained in healthy controls (McGee et al., 1991). Our finding may be explained by the possible beneficial symptomatic effects of ventilation, including lessening daytime fatigue and reduced anxiety.

In line with these findings in ALS, we observed in 17 patients with a LIS caused by a vascular brainstem lesion (mean age, 44 ± 6; range, 33–57 years; 5 females; LIS duration, 6 ± 4 years) that patients' subjective QoL was not related to physical impairment nor could it be predicted by this factor (Ghorbel et al., unpublished). According to the employed Short Form-36 questionnaire (SF-36; Ware et al., 1993) and compared to age-matched French control subjects (Leplege et al., 1998), LIS patients unsurprisingly showed maximal limitations in physical activities and significant limitations in usual role activities because of health problems, and in social activities due to physical or emotional problems. They also showed significant limitations in usual role activities because of emotional problems and scored significantly less on the vitality items (dealing with energy and fatigue). With the exception of the vitality score, all these items showed a significant floor effect (frequent use of the lowest possible score).

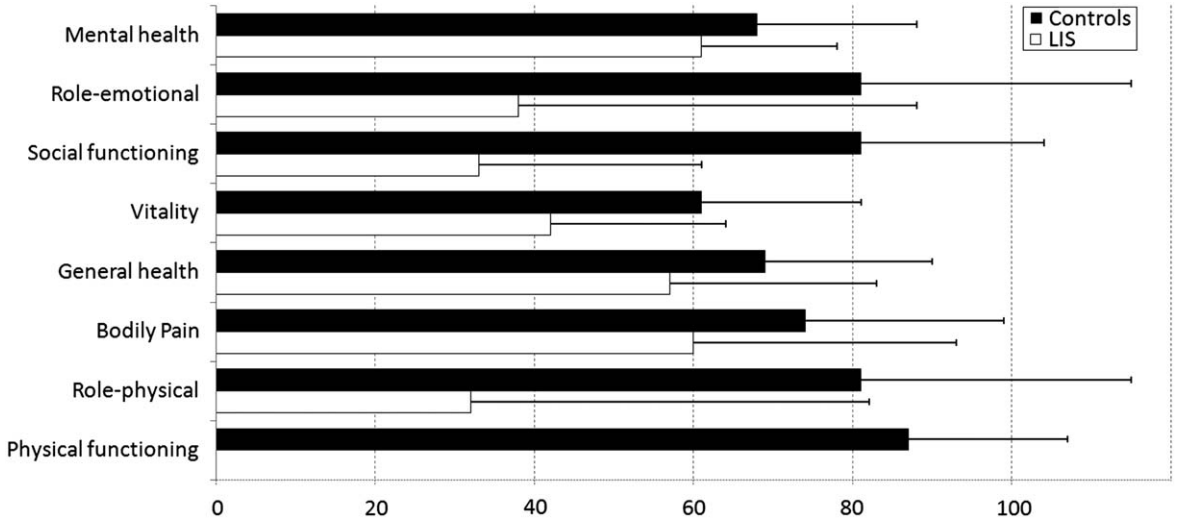

Fig. 1. Short Form-36 self-rated quality of general health status in 17 chronic locked-in patients (caused by brainstem stroke) as compared to healthy age-matched French controls (part of these data were reported in Laureys et al., 2005 with permission from Coma Science group, University of Liége).

Interestingly, self-scored perception of mental health (evaluating mental well-being and psychological distress), personal general health, and bodily pain were close to control values (Fig. 1). We also observed that perception of mental health and the presence of physical pain was correlated to the frequency of suicidal thoughts ($r = -0.67$ and 0.56, respectively, $p < 0.05$).

This "disability paradox" refers to the fact that people with serious and persistent disability report that they experience a good QoL (Albrecht and Devlieger, 1999). In contrast, advanced-stage carcinoma patients show a subjective QoL that seems significantly lower as compared to ALS patients (Fegg et al., 2005) and which continues to decline as the disease leads to progressive physical impairment (Frick et al., 2007; Jenewein et al., 2008). Patients with severe paralysis leading in its most extreme form to a LIS seem to experience a subjective QoL that is better than that of patients with terminal cancer, and comparable to that of patients with nonterminal chronic disease (McGee et al., 1991; Moons et al., 2004). The published literature and the data here presented (summarized in Table 1) suggest that patients at any stage of physical restrictions can subjectively experience a high QoL.

Family members or significant others tend to assume that patients' QoL is poor and underestimate the QoL of patients with chronic illness (McDonald et al., 1996; Sprangers and Aaronson, 1992; Trail et al., 2003). It was shown that when significant others were asked to evaluate the QoL of a patient with severe motor impairment, they rated a significantly lower QoL than did the patients themselves (Kübler et al., 2005). These findings support the assumption of Ganzini and Block (2002) that healthy people may present a defense mechanism having difficulty imagining the feelings and experiences of severely impaired patients. Albrecht and Devlieger (1999) stated that QoL is dependent on establishing and maintaining a harmonious set of relationships within the person's social context and external environment. Appropriate medical and technical intervention as well as social support may strongly influence the QoL of patients with very severe motor impairment. When ALS patients were asked about the determinants of their subjective QoL, health and mobility were factors most often mentioned by patients with clinically relevant depressive symptoms. This indicates that depressed ALS patients seem to define their QoL to a great extent as a function of "external

Table 1. Studies on adaptation to LIS (following brainstem lesion and ALS2)

Study	Number of patients	Etiology	Mean age (years; range)	Good self-scored QoL	Self-scored depression	Time since onset (range or mean)
Doble et al. (2003)	27	Brainstem lesion	34 (1–70)	7/13 (54%)[a]	5/13 (38%)[d]	12–132 months
León-Carrión et al. (2002)	44	Brainstem lesion	47 (22–77)	21/48 (48%)[a]	6/44 (13%)[d]	62 months
Bruno et al. (2008b)	11	Brainstem lesion	43 (27–61)	''Not lower than controls''[b]	NA	84 months
Ghorbel et al. (unpublished) and Laureys et al. (2005)	17	Brainstem lesion	44 (33–57)	''Not lower than controls''[c]	NA	72 months
Bruno and Laureys (unpublished)	53	Brainstem lesion	46 (22–69)	NA	5/53 (9%)	72 months
Zickler (unpublished)	30	ALS	58 (37–72)	23/30 (77%)[c]	9/30 (30%)[e]	41 months
Hacker (unpublished)	33	ALS	58 (37–72)	28/33 (85%)	8/33 (24%)	40 months
Hammer et al. (2008)	39	ALS	58 (37–72)	33/39 (85%)[c]	11/39 (28%)[e]	44 months
Lule et al. (2008)	30	ALS	59 (39–71)	21/30 (70%)[c]	4/30(13%)[e]	NA

NA = not available
[a]As assessed using open questions.
[b]As assessed using ACSA scale.
[c]As assessed using , SF-36, or SEIQoL.
[d]Depression was evaluated using open questions: the question was asked ''Is the patient depressed: often, sometimes, never.''
[e]Depression was evaluated using the ALS depression inventory, ADI (Kübler et al., 2005).

experiences'' that are no longer accessible (i.e., health and mobility). For patients without symptoms of depression, ''internal'' experiences, such as personal well-being, seem to be more important for their QoL (Lulé et al., 2008). Importantly, these areas can remain intact even as the disease progresses. These findings underline the close relationship of QoL and affective state (e.g., depression) and provided support (e.g., social, medical, technical aids). Severely impaired ALS patients more often named communication and medical care as determinants of QoL than did mildly to moderately impaired ALS patients — who did not name these areas as determinants of their QoL at all (Lulé et al., 2008). This suggests that specific determinants become increasingly important for patients' subjective QoL, while physical impairment worsens. Such an adaptation to disease is referred to as response shift (Sprangers and Schwartz, 1999).

Psychological adaptation in LIS

Psychological adaptation to extreme motor impairment is mediated by coping strategies, coping resources, and social support (Matuz et al., submitted) and thus is the prerequisite for a high QoL in LIS. Factors which help to cope with the disease are various and may change in the course of the disease. Avoidance showed to be a successful strategy at the beginning of the disease, but became nonadaptive as the disease progressed (Matuz et al., submitted). In accordance with our previous studies (Lulé et al., 2008), Neudert and colleagues confirmed that ALS patients shift their priorities with respect to QoL and focus more on social aspects (Neudert et al., 2001). Such an adaptive response shift was also found by Zickler (unpublished). With the progression of the disease, ALS patients named family and social contact more frequently as a determining factor of their subjective QoL. Data from Zickler (unpublished) showed the importance of family contacts (comparison between first and second interview 3 months later; $Chi^2(1) = 4.9$, $p = 0.05$, Fisher's exact) and social contacts (second interview $Chi^2(1) = 5.08$, $p = 0.05$). ALS patients named their friends and social environment as determinants of their QoL more often than age-matched healthy controls, who more often mentioned their occupation and

Fig. 2. Satisfaction with factors determining quality of life. Schedule for the evaluation of individual QoL in ALS patients ($n = 30$) and healthy subjects ($n = 30$). The degree of satisfaction in each area was rated on a seven-point Likert scale ranging from 0 (could not be worse) to 100 (could not be better). Adapted from Lulé et al. (2008) with permission from Medical Psychology and Neurobiology, University of Tübingen, and Coma Science group, University of Liége.

financial status. Finally, we observed that ALS patients were more satisfied with their families than healthy control subjects (Lulé et al., 2008; Fig. 2). When patients in LIS of vascular origin were interviewed with the Reintegration to Normal Living Index (Wood-Dauphinee and Williams, 1987), 70% of patients assumed that their role in their family meets their needs and those of their family members (study on 53 patients; mean age, 46 ± 10; range, 22–69 years; 17 females; LIS duration, 6 ± 5 years; Bruno and Laureys, unpublished). Quite in contrast to the assumption of medical doctors, caregivers, and lay people, the physical state does not predict psychological adjustment. Social support, coping strategies, and coping resources predict more than 50% of the variance in psychological adaptation to chronic disease measured as QoL and severity of depression (Matuz et al., submitted). The subjective feeling of control over one's life and the feeling of a purposeful life irrespectively of the actual physical conditions seem to be strong determinants of a good QoL in patients with severe physical impairment (Albrecht and Devlieger, 1999; Matuz et al., submitted). It seems that many LIS patients develop successful adaptive strategies with respect to their needs and priorities in different stages of the disease (Lulé et al., 2008; Matuz et al., submitted). In the ''International classification of Impairment, Disease, and Handicap'' the World Health Organization states that disease, impairment, activity, and life satisfaction are defined as separate aspects of health. The presented data strongly support this notion dissociating physical restrictions from residual QoL in LIS patients.

Depression rate

Depression is a well-described psychological disorder permitting effective psychotherapeutic and pharmacologic treatment (e.g., De Jong-Meyer et al., 2007). Similarly to QoL, the presence of depression can be regarded as a measure of adjustment to the circumstances of the disease. Comparable to the findings for QoL previously discussed, there is evidence that the incidence of depressive symptoms in patients with severe physical impairment is not associated with physical function. This was true for LIS patients when assessed by means of a short self-report on depression (Ghorbel, unpublished; Laureys et al., 2005) as well as for ALS patients when using a

disease-specific screening instrument for depression (Lulé et al., 2008). Likewise, the severity of depressive symptoms in ALS patients was not associated with the time since diagnosis (Kübler et al., 2005; Lulé et al., 2008). For patients with carcinoma, however, depressive symptoms have been reported to correlate with the extent of physical impairment (Frick et al., 2007). The prevalence of depression diagnosed with a structured interview according to DSM-IV criteria among ALS patients is around 9–11% (Ganzini et al., 1999; Rabkin et al., 2000, 2005; Kurt et al., 2007; Hammer et al., 2008) — which is only slightly higher than that observed in the general population (4–7%, Narrow et al., 2002, Kessler et al., 2003) yet lower than among patients with multiple sclerosis (up to 46%, Feinstein and Feinstein, 2001; Galeazzi et al., 2005). Disease-independent factors like level of education (number of school years) correlated significantly with the prevalence of depression in ALS. The higher the education, the lower was the prevalence of depression for ALS patients (Lulé et al., 2008). Although correlations do not tell anything about causal relationships, it might be speculated that better educated people have a better ability to develop functional coping strategies.

Depression and QoL seem anticorrelated in patients with severe motor impairment (Lulé et al., 2008; Kübler et al., 2005) — confirming the well-known relationship of affective state and QoL (Badger, 2001; Kübler et al., 2005). Not only LIS patients with full-blown depression but also with depressed mood should be treated and not be left alone with feelings of hopelessness and despair. This claim is underlined by data showing that an interaction of stress factors like depression and despair cause a mortality risk 6.8 times higher than in patients without these stressors (McDonald et al., 1994). Nevertheless, ALS patients are dramatically undertreated in two ways: first, depression is often left undiscovered; and second, when pharmacologically treated, the dose of antidepressants is too low, and treatment effect is not followed up (Kurt et al., 2007). Psychological interventions tailored to the specific needs of LIS patients which take also into account the progressive nature of ALS are not yet available. In the absence of an empirical basis for the fatalistically postulated causal relationship between the loss of physical function and depression (Goldstein et al., 2006), we conclude that depression is not a widespread phenomenon among LIS patients but when it is identified it should be adequately treated.

Social participation

One of the strongest factors which help to cope with severe motor impairment as seen in LIS and ALS is social support. Matuz and colleagues (submitted) demonstrated that perceived social support is the most powerful predictor for a good QoL and low depression rate. The same was shown by Häcker (unpublished) in a study encompassing 33 ALS patients (mean age, 58 ± 9.0; range, 37–72 years; 18 females; ALS-FRS mean, 20.0 ± 11.0; range, 0–38; diagnosed since 40 ± 31; range, 1–126 months): patients perceiving social support ($n = 24$) rated their QoL significantly higher than patients ($n = 9$) who did not experience the benefit of social support (SIS mean 75.7 ± 11.8 versus 60.7 ± 20.2; univariate ANOVA with age as covariate, $F_{1/25} = 11.9$; $p = 0.002$). Perceived social support could explain almost one-third of the variance between both groups (partial $\text{Eta}^2 = 0.32$).

With the help of family and friends, many LIS patients lead meaningful lives and show strong social participation. Vocational and avocational activities listed by these persons included, among others, visiting with family members, visit vacation home, e-mail, telephone, and teaching. One individual, an attorney, used Morse code eye blinks interpreted by a caregiver so that he could provide legal opinions and keep up with colleagues through fax and e-mail. Another helped to teach maths and spelling to third graders using a mouth stick to trigger an electronic voice device (Doble et al., 2003; Laureys et al., 2005; León-Carrión et al., 2002). In a survey of 44 people diagnosed with LIS, 73% enjoyed going out and 81% met with friends at least twice a month (León-Carrión et al., 2002). Häcker (unpublished) showed that 71% of ALS LIS patients were able

to participate in recreational activities (hobbies, crafts, sports, reading, television, games, computers, etc.) as they wanted to. Given that most LIS patients need support by others, those numbers imply that there must be, and normally are, other people that help and organize this type of activity for people with LIS (León-Carrión et al., 2002).

Alternative communication devices

Another decisive factor for successful adjustment strategies in LIS patients is communication — classically and most basically via an eye movement code (León-Carrión et al., 2002; Laureys et al., 2005). Those functions are usually retained in LIS patients with pontine lesions (León-Carrión et al., 2002) and are usually preserved in ALS patients (Ludolph and Dengler, 1999). However, this way of communication always requires the help of a second person who needs to be willing and capable to follow this time-consuming procedure. Furthermore, LIS patients with progressive etiology like ALS may loose control of eye movement in the end-stage of the disease and are therefore dependent on alternative ways of communication. Assistive communication devices that can be controlled even with one single movement have drastically changed the lives of people with LIS in the last years (Doble et al., 2003; Kübler et al., 2008). Instead of passively responding to the requests of others, the patients can initiate conversation and interaction. Camera-guided systems which scan eye movement or infrared eye movement sensors can be coupled to on-screen virtual keyboards and allow LIS patients not only to communicate via spelling systems on a computer (which can be coupled to a text-to-speech synthesizer to give the LIS patient a ''voice'') but also to control their environment (lights, doorbell, wheelchair, telephone, etc.) (Laureys et al., 2005). To provide LIS patients with a device for communication and control independent of any muscular input, brain–computer interfaces (BCI) have been developed and are continuously improved. Brain activity linked to specific imagery or evoked by sensory stimulation is recorded, filtered, classified, and translated into command signals to control a device (Dornhege et al., 2007). BCIs have been used by LIS patients to communicate (Birbaumer et al., 1999; Neumann et al., 2003; Nijboer et al., 2008), to surf on the Internet (Karim et al., 2006; Mugler et al., 2008), and even to paint (Kübler et al., 2008). BCI-controlled devices also permitted patients with spinal cord injury to regain movement (e.g., grasping could be restored with a BCI linked to functional electric stimulation; Pfurtscheller et al., 2003) and control a wheelchair (Galán et al., 2008; Iturrate et al., 2009). Devices are currently being developed using multiple input channels (speech, muscular and eye movement, and brain activity recording) and with multiple output options (movement, environmental control, communication, or Internet access), which can be easily adapted to the individual's needs (e.g., see www.tobi-project.org). We predict that in near future LIS patients will have even more options to be included in the world of electronic information transfer and social networking.

Wish to die

The discussed studies on successful adaptation in severely disabled patients like LIS and ALS have strong implications for the management, end-of-life decisions, and euthanasia in these challenging patients. Reports from LIS patients contradict the widespread opinion that patients with severe physical impairment inevitably suffer from poor QoL, depression, despair, and hopelessness which, consequently lead to the wish to die. In fact, the wish to die and the request for euthanasia is low, albeit existing, in LIS. In a study on spinal cord injury patients, 95% reported to be glad to be alive (Hall et al., 1999). In retrospective studies in ALS (Kühnlein et al., 2008; Neudert, unpublished) and LIS patients with brainstem lesions (Doble et al., 2003) there was almost no evidence for euthanasia requests although around 35% may have had periodic suicidal thoughts. In the longest surviving group of LIS patients with brainstem lesion (studied after 11 years), 54% had never considered euthanasia, 46% had previously considered it but none of the patients voted

against resuscitation if necessary (Doble et al., 2003). These data demonstrate that almost all of the patients chose to continue living despite severe physical limitations. In reply to the question ''would you like to receive antibiotics in case of pneumonia?'' 80% answered ''yes'' and to the question ''would you like to reanimation to be tempted in case of cardiac arrest?'' 62% answered positively (Bruno and Laureys, unpublished).

The decision not to undergo life-prolonging treatment in severely disabled patients is due to the fear of loss of autonomy and control and to the worry that the lack of mobility and impaired communication will lead to social isolation (Ganzini and Block, 2002). Moreover, it is often assumed that severely paralyzed patients have a poor QoL, particularly when they are on life-sustaining treatment (McDonald et al., 1996). The data presented here and the fact that ventilated ALS patients reported enjoying a significant higher QoL than nonventilated patients contradicts this notion (Lulé et al., 2008; Zickler, unpublished). Many useful therapeutic measures are available, including communication devices that help the patient to maintain autonomy and QoL (Miller et al., 1999; Voltz and Borasio, 1997) by generating a feeling of control over one's own fate. Patients who experience a more internal locus of control also seemed to show less symptoms of depression (Nedele, unpublished).

While the right of individuals to withdraw from treatment should not be questioned, the reviewed data call into question the assumption among some health-care providers and policy makers that severe disability is necessarily perceived as intolerable by the patient her- or himself. Preliminary results from our study on clinicians' perception of LIS show that in 97 interviewed health-care workers the majority (66%) considered that ''being LIS is worse than being in a vegetative or minimally conscious state'' (Bruno et al., 2008b). These prejudices toward LIS may be clinically consequential. Biased health-care workers may provide less-aggressive medical treatment or influence the patient's family in ways not appropriate to the situation (Doble et al., 2003). Information on LIS may be inadequately communicated and the available treatment modalities may be underutilized (Ganzini and Block, 2002). Some authors have argued that optimized palliative care would reduce the number of requests for a hastened death (Ganzini and Block, 2002; Bascom and Tolle, 2002). The understanding of successful adaptation to a life in LIS or ALS is the essential prerequisite for debates about euthanasia and the will to live, especially in the vulnerable nonresponsive patients or the rare cases of complete LIS (e.g., Schnakers et al., 2009) or in the utterly challenging problem of LIS in children (for review see Bruno et al., 2009). As the philosopher Soren Kierkegard put it in 1859, ''If you really want to help somebody, first you must find out where he is. This is the true secret of caring … Helping somebody implies … [that] you must understand what he understands.''

Conclusion

Superficially involved for the short-term of clinical surveillance clinicians may tend to assume that LIS patients will die anyway or would choose to die if they only knew what the clinicians knew (Laureys et al., 2005). Ganzini and Block (2002) suspect that this is due to a psychological defense mechanism: healthy people have difficulty imagining the feelings and experiences of a severely impaired patient and may assume that the patient's QoL is poor (McDonald et al., 1996). As a result, discussions on QoL, withdrawing or withholding of care, end-of-life decisions, and euthanasia are often based on prejudices and the input of the patients themselves is sometimes lacking. Decisions on hastening death or refusal of life-sustaining treatments are still too often made, or at least strongly influenced, by physicians and relatives (Moss et al., 1993; Borasio and Voltz, 1998). Biased clinicians might provide less-aggressive medical treatment and influence the family according to their own biased view of a life in LIS (Doble et al., 2003; Laureys et al., 2005). Likewise, insufficiently informed ALS patients are regularly advised by physicians to refuse intubation and withhold life-saving interventions (Trail et al., 2003). We thus argue that LIS patients — whose competence and cognitive capabilities still

too often are underestimated (e.g., Schnakers et al., 2008) — have to be exhaustively informed about their options to continue life (or not). We need to increase our efforts to integrate these extremely motor handicapped patients in social life and offer the patients who fail to adapt with adaptive coping strategies. The presented data provide evidence that a life with LIS can be worth living, provided the organization of medical, emotional, and social support (including adapted communication devices). LIS patients may regain a productive life and become active members of society; they may return to live at home and can start a new, different, but meaningful life.

Acknowledgments

This work was supported by funds by the European Commission (DISCOS, Mindbridge, and COST), McDonnell Foundation, Mind Science Foundation, and the Belgian Fonds de la Recherche Scientifique (FRS). S. Laureys and M. A. Bruno are, respectively, Senior Research Associate and Research Fellow at FRS.

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