The relationship between cognitive performance and employment and health status in long-term survivors of the acute respiratory distress syndrome: results of an exploratory study

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Abstract

Survivors of acute respiratory distress syndrome (ARDS) are at risk for long-lasting cognitive decline due to hypoxemia, sepsis and/or psychological sequelae associated with aggressive supportive care in the intensive care unit (ICU). We conducted an exploratory study to assess cognitive performance in long-term survivors of ARDS and to investigate how cognitive functioning is related to employment status and health-related quality of life (HRQOL). At median time of 6.0 years after ICU discharge, forty-six ARDS survivors were tested with SKT, a short cognitive performance test for assessing deficits of memory and attention. A measure of HRQOL (SF-36 Health Status Questionnaire) was also administered, and in a brief psychiatric interview, employment status was rated. 23.9% (n = 11) of the patients showed cognitive impairments. However, no extreme and severe cognitive deficits were recorded. They primarily revealed low levels of cognitive function in various tasks assessing attention skills. Disability was found in 41.3% (n = 19) of the patients. All ARDS survivors with cognitive deficits were disabled, whereas only 22.9% (n = 8) of the cognitively not impaired patients gave evidence of disability. The SF-36 values of the ARDS survivors indicated impaired health status on seven out of eight domains when compared to normative population data. Patients with cognitive deficits described the lowest HRQOL with major limitations in the domains role-physical and social functioning when compared to patients without cognitive impairments. In conclusion, long-term ARDS survivors exhibit impaired health status and the presence of cognitive deficits is associated with disability and considerable impairments in HRQOL. More detailed psychiatric research is required to establish the etiology of these cognitive impairments. © 2001 Elsevier Science Inc. All rights reserved.

Keywords: Acute respiratory distress syndrome; Cognitive function; Employment status; Health-related quality of life; Consultation-liaison psychiatry

1. Introduction

During the past 30 years, intensive care treatment of critically ill patients has tremendously improved associated with significant advances in modern technology. Apparently, these exciting medical achievements have fundamental implications for modern consultation-liaison psychiatry, as they have an important impact on the survivors’ psychosocial outcome [9]. Hence, the success of intensive care management of severe diseases such as acute respiratory distress syndrome (ARDS) is no longer judged solely by its effects on survival but by its influence on patients’ psychosocial well-being [6].

Outcome studies of ARDS survivors mainly focus on survival rates and pulmonary function outcomes (e.g. [27]), whereas studies on health-related quality of life in these patients are rare [20,23]. Moreover, only one study has investigated cognitive and psychological outcomes in ARDS survivors [14]. This prospective 1-yr outcome study has shown that 100% of these patients experienced cognitive impairments at hospital discharge, and 30% of them still exhibited generalized cognitive decline at 1 year-follow-up. The pathogenesis of these cognitive problems was not clear. The authors found that the studied ARDS survivors suffered prolonged hypoxemia while on ICU that could lead to brain injury. Alternately, it was discussed whether sepsis that represents a principal reason for the development
of ARDS might result in cognitive decline due to its brain-injuring toxic effects.

To our knowledge, no study has examined cognitive performance and its influence on employment status and health-related quality of life in long-term survivors of ARDS. As ARDS survivors are more concerned about quality of life than longevity [23], comprehensive measurements targeting psychosocial adaptation after recovery from ARDS in the long-term course are of paramount importance. C/L-psychiatrists and other health-care providers thus will be able to enhance appropriate counseling of ARDS survivors and their relatives.

The main purpose of this exploratory study was to assess cognitive performance in long-term ARDS survivors admitted to a 20-bed multidisciplinary ICU of a tertiary care university hospital, and to investigate how cognitive functioning is related to employment status and health-related quality of life.

2. Methods

2.1. Subjects

Of 192 ARDS patients consecutively admitted to the Department of Anaesthesiology at the Klinikum Grosshadern (Ludwigs-Maximilians University, Munich, Germany), a major referral and tertiary care center, 119 patients survived and were discharged between January 1985 and January 1995. On retrospective analyses, all patients met the ARDS criteria of the American-European Consensus Conference for ARDS founded in 1994 [4].

In 1998, this C/L–psychiatric exploratory study was conducted to assess cognitive performance, employment status and health-related quality of life in long-term ARDS survivors. Of the above-mentioned 119 ICU survivors, 17 patients were dead after discharge, and 43 patients could not be located or were living abroad. 59 patients were invited to participate in psychiatric interview but 13 patients declined, bringing the sample population to 46. They represent 39% of the 119 original ICU survivors. The 56 patients who were alive at follow-up but were not included in the sample did not differ from study subjects in terms of age, gender, or medical data.

Table 1 presents information on demographic and medical data. The mean number of years from ICU discharge to performance of psychiatric interview was 6.4 (range: 1 to 12) (median: 6.0 years). All participating patients (mean age: 41.5±14.7 years) had severe lung damage with high mean lung injury scores (LIS) of 3.2±0.3 at admission to intensive care unit (ICU), and were mechanically ventilated for a mean number of 32.3±21.1 days. Patients were treated in the ICU for a mean±SD of 43.7±42.8 days (range, 8–235 days). The acute physiology and chronic health evaluation (APACHE II), a score for assessing severity of somatic disease with prognostic implications, revealed high mean values of 22.8±5.9 indicating severe disease on ICU admission. Six patients (13%) even required extracorporeal membrane oxygenation (ECMO), which was used in addition to standard therapy.

All participating patients gave their informed consent. The study was approved by the Institutional Review Board of our institution. Data protection met the standard set by German law.

2.2. Measures

2.2.1. Neuropsychological test

Patients were tested with the SKT, a short cognitive performance test for assessing deficits of memory and attention [7]. The test quantifies mnestic and attentional deficits in patients suffering from organic or nonorganic psychiatric disorders that cause cognitive impairments. Memory is assessed by means of three subtests that require immediate recall (subtest II), delayed recall (subtest VIII), and recognition memory (subtest IX). The subtests naming objects (subtest I), naming numerals (subtest III), arranging blocks (subtest IV), replacing blocks (subtest V), counting symbols (subtest VI) and reversal naming (subtest VII) investigate attention in the sense of speed of information processing. Norm values exist for the patient’s total test performance. They take into account four age groups (17 to 44; 45 to 54; 55 to 64; over 65) and three different levels of premorbid intelligence (IQ less than 90; IQ 90 to 110; IQ more than 110). According to the manual [7], IQ can be determined by history of the patient’s educational and vocational levels. The SKT total scores (norm values, range from 0 to 27) differentiate between profound (24 to 27), severe (19 to 23), moderate (14 to 18), mild (9 to 13), subthreshold (5 to 8) cognitive disorders, and no cognitive deficits (0 to 4). Published reliability data varied between .86 and .88. The SKT was successfully validated in Germany, England, Russia and Greece [18].
2.2.2. Employment status
In a short psychosocial interview, the patients’ employment status were rated at median time of 6.0 years after ICU discharge with respect to the following criteria: (a) full-time/part-time employment, (b) unemployment, (c) retirement, (d) part-time employment due to health-related reasons, (e) homemaker in lieu of paid employment due to health-related reasons, (f) Disabled from work because of health problems. According to WHO [30], disability is the consequence of impairment, in terms of functional performance and activity by the afflicted person. Hence, we classified the ARDS survivors as disabled if they met the criteria (d), (e), or (f).

2.2.3. Health-related quality of life (HRQOL)
To assess HRQOL after intensive care treatment of ARDS, we applied the psychometrically validated German translation of the Medical Outcome Study Short Form (SF-36) [5,26]. The SF-36 was originally designed as a general indicator of health status for use in population surveys of health policy, but can also be applied to a wide range of types and severities of health-related conditions [29]. It includes 36 questions that cover eight domains (physical functioning, role-physical, bodily pain, general health, vitality, social functioning, role-emotional, mental health). Each domain yields a score ranging from (0) to 100 (best).

The SF-36 is a self-rating questionnaire. Published internal consistency data of the SF-36 exceeded 0.8 in the vast majority of the studies including a study on a sample of long-term survivors of ARDS [23].

2.3. Statistical Procedures
This exploratory study examines the long-term status in a selected cohort of ARDS survivors. The ARDS survivors were divided into two subcategories of patients based on whether cognitive function was impaired or not impaired. SF-36 data were compared with data from normative population (I) whose individuals were drawn at random with respect to age and gender from a large data base (n = 3000) used for validation of the SF-36 in Germany. Cognitive data were compared with data from normative population (II) whose age-related reference scores stem from SKT data bank available at GEROMED, Erlangen, Germany.

All statistical analyses were performed using SPSS 9.0 for Windows. Descriptive statistics were carried out on demographic, medical and psychometric (SKT and SF-36—scores) data, and are presented as mean±SD, and ranges when appropriate. Spearman’s correlations were applied between SKT total test data of the entire sample and age, ICU days, the number of days intubated, Acute Physiology and Chronic Health Evaluation (APACHE) II scores, Lung Injury Scores (LIS), and the number of years from ICU discharge to performance of psychometric assessments. Kruskal-Wallis-test was applied between SKT total test scores of the entire sample and risk factors associated with Acute Respiratory Distress Syndrome (ARDS). Mann-Whitney U test was carried out between SKT total test data of the entire sample and gender, and Extracorporeal Membrane Oxygenation (ECMO). Employment status data (disabled vs. not disabled) were compared with the two groups of ARDS patients (cognitive deficits vs. no cognitive deficits), using Fisher’s exact test. Wilcoxon signed ranks test was used for comparison of SF-36 data between the total sample of ARDS survivors and the normative population (I). To compare SF-36 test scores between the two subcategories of ARDS patients (cognitive deficits vs. no cognitive deficits), Mann-Whitney U test was applied. Wilcoxon signed ranks test was carried out for comparison of SKT data between the total sample of ARDS survivors and the normative population (II). Bonferroni adjustments were not made when calculating with nonparametric tests (e.g. Mann-Whitney U test, Wilcoxon signed rank test).

3. Results
3.1. Cognitive outcome
Based on thorough history taking of the patients’ educational and vocational levels, two different levels of premorbid intelligence could be determined in the entire sample: 37 of 46 ARDS survivors (80.4%) were assigned an IQ from 90 to 110, 9 of them (19.6%) were given an IQ over 110. Considering these retrospectively assessed levels of premorbid intelligence and taking into account the four age groups (aged from 18 to 44; 45 to 54; 55 to 64; and older than 65 years of age; see Table 1), we found that the mean SKT total score (expressed as norm values) from the whole sample of long-term ARDS survivors was 2.76±3.37 at median time of 6.0 years after ICU discharge, and lay well under the cut-off point of 5. However, nearly one-fourth (n=11, 23.9%) of the ARDS survivors showed cognitive impairments as measured on the SKT (mean SKT total score = 7.55±1.22; range, 5 to 16). No extreme and severe cognitive deficits were recorded. One patient scored a norm value of 16, demonstrating signs of moderately severe disturbance of cognitive functions. The other ten patients of the cognitively impaired group valued SKT total scores indicating subthreshold cognitive disorders (n=7, SKT norm values ranged from 5 to 8) or mild cognitive disorders (n=3, SKT norm values ranged from 9 to 13).

The cognitive outcome of the entire sample of long-term ARDS survivors as evidenced by their performance on the SKT was not significantly related to any of the following variables: gender (P=.102), age (r=.262, P=.078), APACHE II scores (r=-.315, P=.090), LIS (r=-.063, P=.809), ICU days (r=.176, P=.284), number of days intubated (r=-.092, P=.734), number of years from ICU discharge to psychiatric-psychometric assessment (r=.084, P=.578), use of ECMO (P=.330), risk factors associated with ARDS (χ²=1.679, df=3, P=.642).
Cognitive tasks

<table>
<thead>
<tr>
<th></th>
<th>Total sample (n = 46)</th>
<th>Age-related reference scores from the SKT data bank</th>
<th>p&lt;sup&gt;2&lt;/sup&gt;</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>SD</td>
<td>Mean</td>
</tr>
<tr>
<td>SKT total score&lt;sup&gt;a&lt;/sup&gt;</td>
<td>2.76</td>
<td>3.37</td>
<td></td>
</tr>
<tr>
<td>I: naming objects&lt;sup&gt;b&lt;/sup&gt;</td>
<td>9.09</td>
<td>3.42</td>
<td>9.81</td>
</tr>
<tr>
<td>II: immediate recall&lt;sup&gt;b&lt;/sup&gt;</td>
<td>4.59</td>
<td>1.78</td>
<td>4.77</td>
</tr>
<tr>
<td>III: naming numerals&lt;sup&gt;b&lt;/sup&gt;</td>
<td>8.41</td>
<td>4.42</td>
<td>6.66</td>
</tr>
<tr>
<td>IV: arranging blocks&lt;sup&gt;b&lt;/sup&gt;</td>
<td>17.96</td>
<td>7.01</td>
<td>16.31</td>
</tr>
<tr>
<td>V: replacing blocks&lt;sup&gt;b&lt;/sup&gt;</td>
<td>14.85</td>
<td>4.66</td>
<td>13.28</td>
</tr>
<tr>
<td>VI: counting symbols&lt;sup&gt;b&lt;/sup&gt;</td>
<td>17.12</td>
<td>7.56</td>
<td>17.29</td>
</tr>
<tr>
<td>VII: reversal naming&lt;sup&gt;b&lt;/sup&gt;</td>
<td>25.02</td>
<td>11.16</td>
<td>21.20</td>
</tr>
<tr>
<td>VIII: delayed recall&lt;sup&gt;b&lt;/sup&gt;</td>
<td>4.09</td>
<td>1.82</td>
<td>4.15</td>
</tr>
<tr>
<td>IX: recognition memory&lt;sup&gt;b&lt;/sup&gt;</td>
<td>0.80</td>
<td>1.42</td>
<td>0.58</td>
</tr>
</tbody>
</table>

<sup>a</sup> Norms for evaluating the patient’s performance exist for four age groups (17 to 44, 45 to 54, 55 to 64, and older than 65 years of age) and three levels of premorbid intelligence (intelligence quotient (IQ) less than 90, IQ 90 to 110, and IQ over 110) [7].

<sup>b</sup> Raw scores for subtests II, VIII, and IX indicate missing objects in the memory tasks (maximum score: 12). For the other subtests the time required by the patient to fulfill the task is given in seconds (maximum score: 60). SKT total scores are given in norm values (range: 0 –27) [7].

<sup>c</sup> Wilcoxon signed ranks test.

Raw scores of the three subtests concerning memory functioning (II: immediate recall; VIII: delayed recall; IX: recognition memory) are depicted in Table 2 for the total sample of ARDS survivors and the age-related normative population (II). When compared with age-related reference scores from the normative population (II), our ARDS survivors did not significantly worse on the memory functioning subtests (II: Z = –.823, P = .410; VIII: Z = –.071, P = .943; IX: Z = –.648, P = .517). Table 2 shows raw scores of the six subtests measuring attention functioning (I: naming objects; III: naming numerals; IV: arranging blocks; V: replacing blocks; VI: counting symbols; VII: reversal naming). Our ARDS survivors revealed significant cognitive outcome differences in the subtests I (Z = –2.644, P < .01), III (Z = –2.999, P < .01) and V (Z = –2.116, P < .05), when compared with controls from the normative population (II).

Hence, various cognitive skills in the attention domain were mainly impaired in our ARDS survivors, whereas memory functioning did not significantly discriminate between the study sample and the age-related reference scores from the SKT Data Bank.

3.2. Employment status

The analysis of the employment status of the entire sample showed that 21 of 46 long-term ARDS survivors (45.7%) were full-time employed, 11 (23.9%) were disabled from work because of health, 5 (10.9%) were homemakers in lieu of paid employment, 4 (8.7%) were retired due to age-related reasons, 3 (6.5%) were part-time employed due to health-related reasons, and 2 (4.3%) were unemployed. Hence, 19 ARDS survivors (41.3%) could be classified as disabled by WHO - criteria. There was a significant relationship between cognitive function and employment status (χ<sup>2</sup> = 20.544, df = 1, P < .001; Fisher’s Exact Test P < .001).

Most interestingly, all patients with cognitive impairments (n=11) were disabled, whereas only 22.9% (n=8) of the cognitively not impaired patients gave evidence of disability.

3.3. Health-related quality of life

At median time of 6.0 years after ICU discharge, the means for the SF-36 subscales showed that the total sample of ARDS survivors performed best on social functioning (SF) (79 ± 27), physical functioning (PF) (72 ± 26), role-emotional (RE) (70 ± 41), and bodily pain (BP) (66 ± 29), and worst on vitality (V) (49 ± 17), general health (GH) (58 ± 22), role-physical (RP) (58 ± 44), and mental health (MH) (66 ± 21). Compared with age and gender comparable normative data (PF 93 ± 12, RP 90 ± 24, BP 85 ± 22, GH 70 ± 17, V 65 ± 18, SF 89 ± 21, RE 95 ± 14, MH 70 ± 18), the SF-36 values of the ARDS survivors significantly differed on all domains but “mental health”. The main differences were found on PF (Z = –4.402, P < .001), RP (Z = –3.860, P < .001), BP (Z = –3.550, P < .001), and V (Z = –3.731, P < .001).

Among the studied ARDS survivors, patients with cognitive impairments reported significant reductions in SF-36 scores on the whole when compared to age and gender-related normative data (PF 65 ± 22, RP 36 ± 39, BP 55 ± 30, GH 54 ± 22, V 46 ± 21, SF 70 ± 22, RE 55 ± 43, MH 62 ± 21). Compared with ARDS survivors without cognitive impairments (PF 75 ± 27, RP 65 ± 43, BP 70 ± 29, GH 59 ± 22, V 50 ± 21, SF 81 ± 28, RE 75 ± 39, MH 67 ± 21), these patients' self-reports on the SF-36 revealed differences on the domains RP (Z = –1.917, P < .05) and SF (Z = –2.097, P < .05) reaching statistical significance (see Fig. 1).
Fig. 1. Comparison of the mean scores of the SF-36 health-related quality of life questionnaire between the two subgroups of long-term ARDS survivors: Cognitively not impaired ARDS survivors (n = 35) (plotted on the left side of the figure) versus cognitively impaired ARDS survivors (n = 11) (plotted on the right side of the figure). Normal Score = 100. Health Status Scale abbreviations: PF = physical functioning; RP = role-physical; BP = bodily pain; GH = general health; V = vitality; SF = social functioning; RE = role-emotional; MH = mental health; The “whiskers” at the top and bottom of each box represent the minimal and maximal values of the distribution respectively, the top and bottom of each box the 75th and 25th percentiles, and the line through the box the 50th percentile. * indicates outliers. * indicates significance at < .05 (Mann-Whitney U test).

4. Discussion

To summarize, first, we found that over three-fourths of patients in our sample of ARDS survivors did not display signs of cognitive impairments at median time of 6.0 years after ICU discharge. This was a main finding in terms of the natural history of cognitive performance following ARDS. As we know from the only study published in the literature targeting cognitive sequelae after ARDS as the primary outcome variable, the prevalence rate of cognitive impairments was 100% at the time of hospital discharge. Noticeable improvement in cognitive performance was recorded already one year after onset of ARDS, as only 30% of patients exhibited generalized cognitive decline [14]. These findings suggested a shift in the global cognitive functioning from impaired to non-impaired status in a substantial portion of ARDS survivors over time. On the other hand, nearly one-fourth of ARDS survivors had SKT test results indicative of cognitive impairments. However, they vastly indicated subthreshold or mild cognitive disorders and none of the patients scored values meeting criteria for extreme or severe cognitive decline. In this context, we want to emphasize that the SKT has proved to be particularly sensitive in the range from questionable to moderately severe cognitive disorders [18]. Interestingly, Hopkins et al. [14] stated that the identification of cognitive impairments in their ARDS survivors was based on sensitive neuropsychological tests. Otherwise, they might have been missed during routine neurological examinations.

Second, the most interesting result of our study seemed to be the nature of cognitive impairments. At median time of 6.0 years after ICU discharge, cognitive deficits in ARDS survivors were due to low levels in various SKT tasks assessing attention skills. Some areas of attention in terms of speed of information processing were affected, whereas the spectrum of memory concerning immediate recall, delayed recall and recognition memory was not impaired. In the literature, it has been discussed that patterns of reduced attentional capacity may be related to “psychological distress” or emotional problems regardless of physical conditions, as it has been reported in patients with multiple traumas [8], with chronic fatigue syndrome [19], with fibromyalgia [25]. Interestingly, depressed patients have been described displaying impairments in the areas of attention [28]. In this context, it is worth reporting that Hopkins et al. [14] performed a few depression rating scales (e.g. Beck Depression Inventory) in order to investigate whether depressive states were present in their ARDS survivors, what might influence their cognitive performance. They found measures of depression within normal range.

To deepen discussion of the pathogenesis of cognitive impairments in ARDS survivors, we point out that cognitive performance of our sample was not related to essential medical data such as APACHE II scores, number of days intubated, use of ECMO, and, particularly, risk factors associated with ARDS. At least, sepsis that caused ARDS in over one-third of our patients, could have contributed to cognitive dysfunction, as one study stated a close relationship between long-lasting cognitive impairments and sepsis with its brain-injuring toxic effects [24]. In the study of Hopkins et al. [14], continuous pulse oximetry was measured while patients were mechanically ventilated, and their patients, indeed, experienced prolonged hypoxemia. Therefore, they supported the idea that cognitive deficits in ARDS survivors might be put down to hypoxia. In the literature, obstructive sleep apnea syndrome that is characterized by hypoxia was found leading to cognitive impairments [3]. Moreover, impaired memory was linked to hypoxemia, and, further, to hippocampal atrophy [13], whereas impaired attention was related to other reasons such as psychological distress [8]. Schelling et al. [23] found an overall rate of 27.5% of posttraumatic stress disorder (PTSD) in ARDS survivors what has been principally confirmed by Kaphammer et al. [16] in a psychiatric follow-up study using SCID-I according to DSM-IV (American Psychiatric Association) [1]. Considering these results, the hypothesis can be raised that the pattern of reduced attentional capacity observed in our ARDS survivors might be related to psychological distress in terms of posttraumatic stress symptoms. Indeed, it is conceivable that ARDS patients may be traumatized during the weaning process from mechanical ventilation in the ICU, as the successful withdrawal from the ventilatory support requires a certain degree of consciousness during a
highly stressful stage of the ARDS treatment [21,22]. This may lead to a history of traumatic experiences of suffocation, associated with severe anxiety and panic, at least in a subgroup of ARDS patients. PTSD, by definition, is accompanied by persistent symptoms of increased arousal that hampers concentrating. Furthermore, it has been suggested that impaired concentration in PTSD patients may be associated with stress-induced corticosterone production decreasing hippocampal activity [11]. Given psychological sequelae in terms of posttraumatic stress syndrome in ARDS survivors, attentional problems might be partly or fully resolved by administering serotonin selective reuptake inhibitors (SSRIs), as serotonin seems to play a crucial role in the capacity of the septohippocampal system to activate inhibitory pathways preventing the initiation of emergency responses [10]. Another possible treatment approach for attentional deficits owing to high levels of anxiety could involve relaxation techniques. A few studies in the elderly have suggested that relaxation training may improve attention by reducing anxiety [31,32].

The present study confirmed the previous observations that a considerable portion of ARDS survivors returned to work: McHugh et al. [20] noted 56%, Schelling et al. [23] reported 61.3%, we found 58.7%. Taking into account that ARDS is a life-threatening disease with a high mortality rate, disability rates in the short-term (44%) [20] and in the long-term courses (41.3%) [23] could be considered as relatively low, particularly when compared to rates of disabilities in liver transplant recipients (80%) [15].

Most interestingly, all of our ARDS survivors displaying cognitive impairments were classified disabled. On the other hand, only 22.9% of those without cognitive problems met criteria for disability. This difference reached statistical significance indicating that cognitive impairment subsequent to ARDS is a major obstacle to employment. Disability of returning to work usually implies negative social consequences for the patients (e.g. living conditions, economic status, recruitment of adversity) [12].

Further, we want to emphasize that our ARDS survivors with cognitive impairments performed worst on all eight domains of the SF-36. This result was in accordance with that published by Hopkins et al. [14]. They stated that their ARDS survivors, who were 100% cognitively impaired at the time of hospital discharge, showed impairments on all of the scales of the SF-36. After 1-yr follow-up, prevalence rates of cognitive deficits decreased, and, paralleling this course, patients’ SF-36 self-reports improved, especially on PF, SF, and RP. Correspondingly, our ARDS patients with cognitive problems definitively displayed decrements on the health-related categories RP and SF reaching statistical significance in comparison to those ARDS patients without cognitive impairments. By definition, low scores on RP mean “problems with work or other daily activities as a result of physical health”, and, low scores on SF indicate “extreme and frequent interference with normal social activities due to physical and emotional problems”. Obvi-

ously, the cognitive deficits experienced by our ARDS survivors were associated with impaired HRQOL. It should be noted that the SF-36 lacks items about cognitive function. A recent study on health-related quality of life with residents of nursing homes revealed that the utility of the SF-36 might be limited to assessments of subjects with higher cognitive and physical functioning than typical nursing home residents [2]. In this context, it is worth noting that our ARDS survivors indicating cognitive impairments did not show cognitive decline stages that might interfere with test performance on the SF-36.

Finally, there were several limitations of this study to be respected: 1.) The relatively low participation rate of ARDS survivors eligible for psychiatric assessment. 2.) The varying time intervals between discharge from ICU and the psychiatric evaluation. 3.) The SKT did not assess all areas of cognitive function. 4.) Psychometric rating scales measuring different aspects of the patients’ affective status are to be considered in future studies. 5.) The conduction of brain magnetic resonance imaging examining the hippocampus should be proposed in future studies.

In conclusion, our study demonstrated that a subgroup of long-term ARDS survivors exhibited cognitive impairments that were related to disability and impaired health-related quality of life. Further research is warranted to establish the etiology of these cognitive impairments. Definitive treatment approaches for the attentional deficits in a subgroup of long-term ARDS survivors remain to be developed. From a psychiatric point of view, early neuroprotective treatment should be considered, and the efficacy of relaxation training and antidepressants such as SSRIs should be addressed in forthcoming studies designed to improve concentration in this population of patients. Implications for appropriate counseling of ARDS survivors and their families by the psychiatric consultation-liason service in general hospitals should involve identification of cognitive impairments, education of coping strategies, and adequate reintegration in vocational life.

Acknowledgments

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References