HE annual incidence of traumatic brain injury (TBI), defined as injury that requires medical treatment, is conservatively estimated to be about 500,000 persons per year in the United States. One of the major clinical issues in the initial evaluation of patients who present with acute TBI is establishing a prognosis for their long-term outcome.

Jennett and colleagues \(^{11,12}\) used the Glasgow Outcome Scale \(^{11}\) (GOS) to analyze information from the International Coma Data Bank on the 6-month outcome of 1000 patients with severe head injury. Nearly 48% of these patients died, and 12% were categorized as severely disabled or vegetative. Approximately 23% of the patients showed a good recovery whereas 18% were found to be moderately disabled.

Researchers at the National Institutes of Health Traumatic Coma Data Bank researchers studied 746 severely brain injured patients, of whom 50 (7%) had a good recovery, 138 (18%) had moderate disability (measured by the GOS score at the time of hospital discharge), 243 patients (33%) died, and the remaining 315 patients (42%) were either severely disabled or in a vegetative state.\(^{24}\) Levin and colleagues\(^{18}\) reported on the behavioral outcome of 127 severely brain injured patients capable of completing serial neuropsychological assessments during a 1-year follow-up period. At 1 year, the brain-injured patients showed slower information processing and impaired memory function compared with a neurologically intact control group.

Emotional disturbances are perhaps the most socially and vocationally disruptive sequelae of severe TBI.\(^{22,30}\) Patients may experience significant personality changes, becoming childish and dependent, prone to sudden violent outbursts, anxious, or severely depressed. These changes may influence their social relationships, ability to sustain employment, and place a great burden on family members.\(^{3,4}\) A recent study of 124 patients with mild head injuries showed a significant association between emotional disturbance and the degree of neuropsychological impairment.\(^{5}\) Among the emotional problems seen in patients with TBI, mood disturbances are one of the most frequent. Affective disorders following TBI may

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**Key Words**

- depression
- traumatic brain injury
- outcome
- recovery
- emotional disorder
- behavioral disorder
- Traumatic Coma Data Bank
be transient syndromes, lasting a few weeks, or persistent disorders, lasting many months.\textsuperscript{9,22}

During the past few years, we have reported on the frequency, course, clinical manifestations, and clinical pathological correlates of mood disorders following TBI.\textsuperscript{5,12-15} Major depression occurred in 17 of 66 patients (26\%) with acute TBI, and was associated with both premorbid vulnerabilities such as histories of psychiatric disorder and poor social functioning, and specific lesion locations, in particular left dorsolateral frontal cortex and left basal ganglia. This depression was not linked to the degree of physical or intellectual impairment.\textsuperscript{5,14} Transient depression (6 weeks’ duration) was associated with a left anterior lesion location whereas prolonged depression (7 months’ duration) was associated with poor social support and a high frequency of anxiety symptoms.\textsuperscript{14}

In this study, the levels of depressive disorders were analyzed as predictors of the degree of physical, intellectual, and psychosocial recovery experienced by patients during the first year following TBI. We also examined the relationship of these outcome measures and the type and severity of brain injury; lesion location; demographic variables (such as age, sex, race, education, and socioeconomic status); and critical background characteristics such as personal history of psychiatric disorder, previous history of alcohol or drug abuse, premorbid social functioning, and availability of social support.

Clinical Material and Methods

Patient Population

The 66 patients included in this study were consecutively admitted to the Shock Trauma Center of the Maryland Institute of Emergency Medical Services System with acute closed head injury. Traumatic brain injury was classified according to the method of categorization proposed by the National Institute of Neurological Disorders and Stroke Traumatic Coma Data Bank.\textsuperscript{23} Patients were excluded for the following reasons: 1) penetrating head injuries or associated spinal cord injury; 2) multiple system involvement such as fractures which would influence physical recovery or produce significant secondary brain damage as a result of hypovolemic shock or severe hypoxia (abdominal hemorrhages or lung collapse); 3) decreased level of consciousness (drowsy, stuporous, or comatose) or delirium; or 4) aphasic disorders (unable to follow a two-stage command) that interfered with comprehension of questions. The mean interval between TBI and psychiatric interview was approximately 1 month (median 31 days, interquartile range 32).

The 24-hour Glasgow Coma Scale (GCS)\textsuperscript{29} score was used to determine severity of brain injury: mild, GCS 12 to 15; moderate, GCS 8 to 11; or severe, GCS 3 to 7. Patients with GCS scores between 12 and 15 but who underwent intracranial surgical procedures or had focal lesions greater than 25 cc were considered to have moderate head injury.\textsuperscript{17} Sixty-eight percent of the patients were placed in the moderate head injury category; severe and mild head injuries were 17\% and 15\%, respectively. Scores on the GCS ranged from 3 to 15, with a median of 10 and an interquartile range of 6.

Most of the patients had been involved in a motor-vehicle accident. None had a depressive disorder at the time of TBI and none had suffered a head injury as a result of a suicide attempt. Informed consent to participate in the study was obtained from all patients.

Follow-up evaluations were performed at 3, 6, and 12 months post-trauma. The percentage of patients lost to follow-up study was 18.2\% at 3 months and 34.8\% at both 6 and 12 months. Fifty-two patients (79\%) completed at least three of four evaluations and became the subjects of the follow-up analysis.

Psychiatric Interview

A structured psychiatric interview was conducted using a version of the Present State Examination\textsuperscript{2} that had been modified to elicit symptoms related to mood and anxiety disorders. Diagnosis of these disorders was established from the Diagnostic and Statistical Manual of Mental Disorders, revised, ed 3 (DSM-III-R).\textsuperscript{1} The structured psychiatric interview also included questions on family and personal history of psychiatric disturbances. Data on alcohol or other substance abuse in the family or personal history were collected from each patient and any relative present at the time of TBI and none had suffered a head injury as a result of a suicide attempt. Informed consent to participate in the study was obtained from all patients.

Cognitive function was measured using the Mini-Mental State Examination (MMSE),\textsuperscript{27} which has been shown to be a reliable and valid means of assessing cognitive functioning in a brain-injured population.

Impairment in activities of daily living (ADL’s) was measured using the Johns Hopkins Functioning Inventory (JHFI) scale.\textsuperscript{27} This scale measures functional independence (ability to perform room tasks, sphincter control, dressing, and eating) as well as communicative functions (ability to express needs, comprehension of spoken language, and reading comprehension). Scale scores range from 0 to 27 with higher scores indicating a more severe functional impairment.

Quantitative assessments of social functioning were made using the Social Functioning Examination (SFE) and the Social Ties Checklist (STC).\textsuperscript{28} The SFE assesses the quality of interpersonal relationships (parents, spouse, children, and partners in the household), work experience, economic practices, social activities, and use of community resources. Scores range from 0.00 to 1.00 with higher values indicating poorer levels of functioning. The STC records the number of social connections available to the patient. Scores range from 0 to 10. Higher scores are evidence of less social support. In a prior publication,\textsuperscript{29} we have
shown the interrater reliability of the total score on the SFE to be \( r = 0.92, p < 0.01 \). After obtaining all relevant information, the interviewer rates each SFE as not impaired, moderately impaired, or severely impaired. The STC records whether the patient belongs to clubs, church groups, or sees friends. Self-report information on social functioning level and availability of social support was checked with the patient’s close relatives or significant informants, if available.

**Neuroimaging Classification**

Computerized tomography (CT) scans were obtained at the time of admission to the Maryland Institute of Emergency Medical Services System, usually within 1 day following the trauma. Follow-up CT scans were usually obtained 1 or 2 weeks later, and all scans were done on a scanner with standard 10-mm axial cuts parallel to the canthomeatal line. All lesion locations were transposed to templates using the procedure described by Levine and Grek. All scans were independently read by two neurologists (S.E.S. and R.E.J.) who were blinded to the results of the psychiatric examination. The interrater reliability (kappa values) for the different neuroradiological measurements ranged from 0.81 to 1.00.

**Statistical Analysis**

The longitudinal evolution of cognitive, physical, and psychosocial measures in this study was of primary interest to the researchers. The amount of improvement or deterioration during the 1-year follow-up period was measured, and change was estimated for each of the 52 patients using a simple linear regression of time (months postinjury) on each of three impairment scales (MMSE, JHFI, and SFE).

The slope (B) was taken as the degree of change that each patient showed on that scale. Negative slopes for JHFI and SFE and a positive slope for MMSE reflected recovery. The median of the slopes (B) for each scale was taken as a measure of central tendency for that scale. The interquartile range (p75 to p25) was taken as the dispersion measure.

Patients with a poor outcome were defined as those who showed both a deteriorating slope (negative for MMSE and positive for JHFI and SFE) and a B value that fell outside the interquartile range. Eleven patients (21%) fulfilled the deteriorating slope criterion for poor outcome of SFE, seven (13%) for JHFI, and 11 (21%) for poor outcome of MMSE. The rest of the patients (41 for SFE) constituted the control groups. Mann-Whitney tests were then used to test for group differences in both the slopes and the means. Nonparametric tests were chosen because the distribution of slopes is known to be non-normal.

When comparing the initial psychiatric and impairment variables of the outcome groups, we looked for an overall multivariate test of significance to account for the intercorrelation among variables, and to control for the overall probability of obtaining a significant result by change (alpha error). This was achieved by a nonparametric analog of multivariate analysis of variance (ANOVA) based on ranks. The overall test of significance was taken as a test for the full model including all five variables (HDRS, JHFI, MMSE, SFE, and STC). Logistical regression analysis was used to test for an association between type of outcome and background and lesion location variables. The overall test was used again to control for alpha inflation and interrelations among variables; following the overall test for the full model, backward selection was used to reduce the number of variables examined.

**Results**

**Follow-Up Analysis**

The 52 patients who completed at least three of four evaluations were the subjects of the follow-up analysis; the remaining 14 patients constituted the dropout group. Attrition was almost always due to the patient’s failure to report for follow-up neurosurgical or neurological care. No patient refused an interview. We compared both groups of patients to detect any significant bias and found that between groups there were no significant differences in background characteristics, personal history of psychiatric disease, severity of head trauma, prevalence of depressive disorders, degree of initial physical or cognitive impairment, social functioning, or availability of social support. However, the drop-out group had a significantly higher frequency of orbitofrontal lesions (\( \chi^2 = 4.4; p = 0.04 \)). Logistical regression analysis of the lesion location variables disclosed a significant association between the lesion location and follow-up status (\( \chi^2 = 25.2, df = 12, p = 0.014 \)).

**Background Characteristics**

The background characteristics of the poor-outcome and control groups are shown in Table 1. The proportion of African American patients was significantly greater in the poor SFE outcome group (\( \chi^2 = 5.7; df = 1; p = 0.02 \)); these patients also showed a significantly lower educational level (Mann-Whitney U-test = 120, \( p = 0.01 \)). Although the proportion of patients with a personal history of alcohol or drug abuse or belonging to Hollingshead’s Classes IV and V was higher in the poor SFE and JHFI outcome groups, this difference was not statistically significant.

There were no significant differences between the poor-outcome and control groups in terms of age, sex, and personal or family history of psychiatric disorder. There were no significant differences between the poor-outcome SFE, JHFI, MMSE, and control groups in their mean 24-hour GCS scores or in the distribution of severe, moderate, and mild head injuries (Table 2).

A logistical regression model included the following background variables: age, race, education, socioeconomic status, GCS scores, personal history of psychiatric disorder, and personal history of alcohol or
Influence of depression on traumatic brain injury outcome

**TABLE 1**

*Individual factors and background characteristics in poor outcome and control groups*

<table>
<thead>
<tr>
<th>Factor</th>
<th>Social Poor</th>
<th>Social Control</th>
<th>ADL’s* Poor</th>
<th>ADL’s* Control</th>
<th>Cognitive Poor</th>
<th>Cognitive Control</th>
</tr>
</thead>
<tbody>
<tr>
<td>age</td>
<td>29.8 (7.3%)</td>
<td>29.5 (11.4%)</td>
<td>32.1 (16.3%)</td>
<td>29.1 (9.7%)</td>
<td>24.9 (3.9%)</td>
<td>30.8 (11.5%)</td>
</tr>
<tr>
<td>sex (% male)</td>
<td>82</td>
<td>83</td>
<td>100</td>
<td>80</td>
<td>73</td>
<td>85</td>
</tr>
<tr>
<td>race (% Black)</td>
<td>55</td>
<td>66</td>
<td>43</td>
<td>20</td>
<td>18</td>
<td>24</td>
</tr>
<tr>
<td>SES (% of class IV or V)</td>
<td>90</td>
<td>85</td>
<td>68</td>
<td>18</td>
<td>64</td>
<td>73</td>
</tr>
<tr>
<td>yrs of edac</td>
<td>10 (4.3%)</td>
<td>12.8 (2.0%)</td>
<td>11.7 (2.4%)</td>
<td>12.3 (2.9%)</td>
<td>12.4 (1.4%)</td>
<td>12.1 (3.1%)</td>
</tr>
<tr>
<td>family history of psychiatric disorder</td>
<td>54%</td>
<td>46%</td>
<td>43%</td>
<td>49%</td>
<td>55%</td>
<td>46%</td>
</tr>
<tr>
<td>personal history of alcohol or drug abuse</td>
<td>45%</td>
<td>24%</td>
<td>43%</td>
<td>27%</td>
<td>9%</td>
<td>34%</td>
</tr>
<tr>
<td>personal history of psychiatric disorder</td>
<td>18%</td>
<td>19%</td>
<td>0%</td>
<td>22%</td>
<td>27%</td>
<td>17%</td>
</tr>
</tbody>
</table>

* ADL’s = activities of daily living; SES = socioeconomic status; educ = education; psychiatric = psychiatric.

Drug abuse. A backward selection procedure identified race (African American) as the only background variable significantly associated with a poor psychosocial outcome ($\chi^2 = 6.7; p = 0.009$) (Table 3). Logistical regression analysis of the background variables on ADL (JHFI) and cognitive (MMSE) outcomes did not show a significant association between these variables and the poor-outcome groups (Table 3).

**Initial Psychiatric and Impairment Variables**

We also compared the initial HDRS, JHFI, MMSE, STC, and SFE scores of the poor psychosocial, poor ADL’s, and poor cognitive outcome groups with their respective control groups. Multivariate ANOVA of the five ranked variables did not show an overall significant difference between the groups (SFE Wilk’s Lambda = 0.821; df = 5.46; F = 2; p = 0.0947; JHFI Wilk’s Lambda = 0.855; df = 5.46; p = 0.1893; MMSE Wilk’s Lambda = 0.837; df = 5.46; p = 0.1322). There was a trend for the poor psychosocial outcome group to have lower MMSE scores. Univariate analysis showed that initial MMSE scores differed between the poor-outcome and control SFE groups at the 0.05 level (F = 6.0; df = 1.50; p = 0.02). The poor ADL’s outcome group had higher HDRS scores (ANOVA F = 7.2; df = 1.50; p = 0.001) and the poor cognitive functioning outcome group had significantly lower initial MMSE scores (ANOVA F = 5.9; df = 1.50; p = 0.01). Logistical regression analysis of these variables did not show an overall significant association with the different measures of outcome.

**Type and Location of Brain Lesions**

Of the 11 patients included in the poor psychosocial outcome group, seven (64%) had diffuse patterns of injury on their CT scans, two (18%) underwent surgical evacuation of mass lesions, and the remaining two (18%) had focal lesions greater than 25 cc that did not require a surgical procedure.

Of the seven patients included in the poor ADL’s outcome group, five (71%) had focal lesions, whereas CT scans obtained in two (29%) revealed diffuse patterns of injury. Finally, of the 11 patients who comprised the poor cognitive outcome group, eight (73%) suffered injuries that were categorized as diffuse and the remaining three (27%) underwent surgical evacuation of their focal lesions. There were no significant differences between the SFE and MMSE poor outcome groups and their respective control groups in the frequency of diffuse or focal injury or in the frequency of different injury subtypes. The poor JHFI outcome group, however, had a significantly higher frequency of focal (mass) injuries compared to the control group (Fisher’s exact test, p = 0.03).

To analyze the relationship between lesion location and outcome, a logistical regression model included the following location variables: right or left hemisphere, frontal, temporal, parieto-occipital, and subcortical (that is, lesions involving deep white matter, basal ganglia, brain stem, and cerebellum).

**TABLE 2**

*Relationship between severity of brain injury and outcome for types of functioning*.

<table>
<thead>
<tr>
<th>Injury</th>
<th>Social Poor</th>
<th>Social Control</th>
<th>ADL’s* Poor</th>
<th>ADL’s* Control</th>
<th>Cognitive Poor</th>
<th>Cognitive Control</th>
</tr>
</thead>
<tbody>
<tr>
<td>severe head injuries</td>
<td>11</td>
<td>18</td>
<td>0</td>
<td>20</td>
<td>22</td>
<td>16</td>
</tr>
<tr>
<td>mod head injuries</td>
<td>78</td>
<td>66</td>
<td>100</td>
<td>63</td>
<td>56</td>
<td>71</td>
</tr>
<tr>
<td>mild head injuries</td>
<td>11</td>
<td>16</td>
<td>0</td>
<td>17</td>
<td>22</td>
<td>13</td>
</tr>
</tbody>
</table>

* Data are expressed in percent. ADL’s = activities of daily living; mod = moderate.

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There was an overall significant association between lesion location and a poor psychosocial outcome ($\chi^2 = 16.8; \text{df} = 6; p = 0.009$). A backward selection procedure was then performed to remove the non-significant variables ($p > 0.05$).

The presence of right-hemisphere lesions ($\text{Wald } \chi^2 = 7.6; p = 0.006$) was the only significant lesion correlate of poor psychosocial outcome. There was no significant overall association between lesion location and either poor outcome in ADL's or poor outcome in cognitive function. Poor outcome in ADL's, however, showed a trend of association with the presence of temporoparietal lesions (Table 4).

**Relationship Between Outcome and Presence of Affective Disturbance**

At the initial evaluation, 13 of the 52 patients (25%) with adequate follow-up data were diagnosed with major depression. One patient (2%) experienced minor depression and the remaining 38 (73%) were not depressed. Major depression lasted 6 or more months in six of the 13 patients with acute major depression, six patients reported more transient depressive disorders lasting 3 months at most, and one patient developed a bipolar disorder (mania at 3-month follow-up examination), and met criteria for major depression at the 6-month and 1-year follow-up evaluations. Five patients experienced secondary mania during the follow-up period with an estimated duration of 2 months. These five patients experienced an elevated mood for approximately 6 months without meeting the criteria for mania.

We assumed that the effect of depression on long-term outcome could only be identified in those depressive disorders with a longer course. Thus, six patients suffering from prolonged major depression (6 or more months) constituted the major depression group. The patient with a bipolar disorder and the five with secondary mania constituted the mania group. Finally, 19 patients who did not develop an affective disturbance during the course of the study constituted the non-affective disturbance group. The remaining 21 patients developed a major or minor depression at some time during the 1-year follow-up period and were excluded from this outcome analysis because the duration in some cases was not known or was less than 6 months and the effect of depression during the initial 6 months was being examined.

There was a significant association between poor psychosocial outcome and the presence of major depression (Fisher's exact test, $p = 0.03$). Four of six patients with long-lasting major depression (67%) and three of 19 patients without affective disorder (16%) had poor psychosocial outcomes. Patients with short-term depression (less than 3 months) were then examined. These individuals recovered in a fashion similar to the nondepressed patients. Only one patient of the six had a poor psychosocial outcome.

**TABLE 4**

Logistical regression of lesion location variables on type of outcome*

<table>
<thead>
<tr>
<th>Lesion Location</th>
<th>Social</th>
<th>ADL's</th>
<th>Cognitive</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Wald $\chi^2$</td>
<td>P &gt; $\chi^2$</td>
<td>Wald $\chi^2$</td>
</tr>
<tr>
<td>rt hemi</td>
<td>10.35</td>
<td>0.001</td>
<td>0.535</td>
</tr>
<tr>
<td>lt hemi</td>
<td>0.888</td>
<td>0.346</td>
<td>0.393</td>
</tr>
<tr>
<td>frontal</td>
<td>0.636</td>
<td>0.425</td>
<td>0.427</td>
</tr>
<tr>
<td>temporal</td>
<td>0.007</td>
<td>0.935</td>
<td>3.524</td>
</tr>
<tr>
<td>parieto-occipital</td>
<td>3.211</td>
<td>0.072</td>
<td>3.333</td>
</tr>
<tr>
<td>subcortical</td>
<td>2.537</td>
<td>0.111</td>
<td>1.471</td>
</tr>
</tbody>
</table>

* ADL's = activities of daily living; hemi = hemisphere.
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There was also a significant association between poor ADL's outcome and the presence of major depression (Fisher's exact test, p = 0.03). Two of four patients (50%) with major depression had poor functional outcomes, but none of the 10 patients without affective disorders presented with poor functional outcome. Only one of six individuals with transient depression had a poor functional outcome. There were no significant differences in the frequency of depressive disorders between the poor cognitive (MMSE) outcome and respective control groups. In addition, the incidence of manic syndromes was not significantly different in any of the poor outcome and control groups.

Discussion

Clinical Findings

Over a 1-year period, this study evaluated a group of 52 patients with TBI for the clinical variables associated with a poor physical, cognitive, or psychosocial outcome. Individuals with a poor psychosocial outcome were more likely to be African American, have right-hemisphere lesions, and have experienced major depression that lasted more than 6 months. The frequency of major depression was also significantly higher among patients with a poor ADL's outcome than in the respective control group. A poor ADL's outcome was not significantly associated with background or initial impairment variables, with the severity of brain injury, or with the location of the brain lesion. Finally, patients with poor cognitive outcome had lower initial MMSE scores; however, there was no significant association between major depression and a poor cognitive outcome.

Methodological Limitations

There were several methodological limitations: 1) the patients included in this study were primarily young white males from lower socioeconomic classes; 2) none had clinical evidence that suggested relevant secondary brain damage or a significant disability related to injury of body systems other than the central nervous system; 3) a large proportion (68%) had moderate head injuries; and 4) the percentage of severe and mild head injuries was 17% and 15% respectively. Therefore, these findings may not be applicable to all patient populations with TBI.

The percentage of individuals lost to follow-up study was approximately 21%, and this reduction in the number of patients receiving follow-up examinations affected the power of the statistical analyses. There were no significant differences between the follow-up and drop-out groups in background characteristics, personal history of psychiatric disease, alcohol or drug abuse, severity of head trauma, or prevalence of depressive disorders. Logistical regression analysis of the lesion location, however, revealed that the drop-out group had a significantly higher frequency of lesions in the orbital surface of the frontal lobes. These lesions have been consistently associated with disinhibition, impulsivity, and inadequate planning of behavior, all of which may play a critical role in determining psychosocial outcome. Thus, the association between the presence of frontal lobe lesions and a poor psychosocial outcome may have been underestimated in this study. In addition, the cognitive deficits that follow TBI are often subtle in nature (attention or executive deficits, for example) and may not have been detected by the brief, verbally dominated MMSE. These subtle cognitive deficits might have influenced the patients' ability to cope with occupational and social demands and, therefore, might have established a link between the degree of cognitive impairment and social functioning.

A more detailed and specific neuropsychological evaluation that focused on attention processes, speed of information processing, working memory, executive functions, and emotional communication would be necessary to examine this observation. Finally, the limited sensitivity of CT scanning in detecting structural abnormalities following TBI, such as diffuse axonal injury and nonhemorrhagic cortical contusions, may have limited our clinicopathological correlations. In the future, as nonferromagnetic life support and monitoring devices become available, magnetic resonance imaging will be progressively incorporated in the routine evaluation of acute TBI patients to allow a more precise and reliable method of categorizing these individuals.

Study Implications

Given these limitations, what are the implications of this study? The first is related to the fact that the presence of right-hemispheric lesions and prolonged major depression demonstrates a strong association with poor social functioning outcome. Although patients with moderate head injuries may present with relatively mild physical impairments, they may experience behavioral disorders that have a significant impact on the extent and quality of their interpersonal relationships and their re-entry into the community.26,30 Thus, social functioning represents a sensitive measure of long-term outcome. Lishman20 studied a group of 144 individuals included in the Oxford collection of head-injury records and found that affective and behavioral disorders occurred more commonly after damage to the right hemisphere. Grafman, et al.,8 studied a group of Vietnam war veterans with penetrating brain injuries and also found an association between damage to the right hemisphere and neurobehavioral disturbance. Patients with damage to the right hemisphere may have impaired comprehension of complex, emotionally loaded verbal and nonverbal stimuli, a deficit that may further undermine their interpersonal relationships. Thus, it is conceivable that the presence of depressive and other behavioral disorders associated with a right-hemisphere lesion (such as disinhibition or inability to recognize emotional intonation in others) may significantly influence the psychosocial recovery of TBI patients.
The second important implication of this study is that both a poor psychosocial outcome and poor ADL’s outcome were related to the presence of a prolonged major depression. We have previously reported that acute-onset post-TBI depressions may be subdivided into two groups: the first characterized by a transient course (less than 3 months), an association with left frontal and basal ganglia lesions, and the presence of pure nonanxious depressive syndrome. The second group is characterized by a more prolonged course (more than 6 months), an association with right hemisphere lesions, and the presence of an anxiety disorder (patients met DSM-III criteria for both major depression and generalized anxiety disorder). These prolonged depressive disorders may have a deleterious effect on social functioning, and possibly a most significant effect on physical recovery from TBI. The variables of age, sex, education, socioeconomic status, premorbid levels of social functioning or social support, personal history of psychiatric disorder, or history of alcohol and drug abuse did not appear to be significant predictors of either psychosocial outcome or poor ADL’s outcome. Among these background variables, race was the only one that proved to be a significant predictor of psychosocial outcome. One-half of the African American patients (6 of 12) and 12.5% of white patients (5 of 40) had a poor outcome. The reasons for this finding are unclear. Socioeconomic status was the only significant difference between the two groups in all the background variables. One hundred percent of the African American patients versus 61% of the white patients were categorized in Hollingshead’s IV and V classes ($\chi^2 = 4.9$; df = 1; $p = 0.03$). Socioeconomic status and education were taken as covariates in the logistical regression model and were not significantly associated with a poor psychosocial outcome; this suggests that, when one controls for socioeconomic status, race remains a significant predictor of outcome.

Multivariate analysis of initial impairment variables, however, showed an overall significant difference between African American and white patients (Wilks Lambda = 0.75; df = 6,44; $p = 0.04$). African American patients had significantly higher initial STC scores ($F = 7.9$; df = 1,49; $p = 0.007$) and significantly lower initial MMSE scores ($F = 4.2$; df = 1,49; $p = 0.04$), and so it is conceivable that a combination of lower socioeconomic status, less availability of social support, and impaired cognitive function during a major depression, rather than race, may have led to poor psychosocial outcome.

Although JHFI includes both language assessment and motor function, the fact that there were no other significant predictors of outcome except major depression suggests that our population may have been too homogeneous to demonstrate the influence of factors such as the effect of the nature and extent of brain injury on long-term physical outcome. Nevertheless, this finding of major depression being the single significant predictor of outcome emphasizes the importance of depression in physical recovery. This is consistent with our previous findings in patients suffering strokes, in whom the occurrence of major depression had a negative influence on physical recovery. Because depressive disorders tend to resolve within 1 year, we presume that depression may negatively influence patients’ early participation in rehabilitation efforts and that they do not recover these early losses even when the depression is over.

Conclusions

Major depression appeared to have negatively influenced both the psychosocial and ADL’s outcomes of this group of TBI patients. Future studies are needed to examine the effect of depression on long-term recovery following TBI and, ultimately, to explore the effect of adequate antidepressant therapy on the clinical recovery of TBI patients.

References

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