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Orginal Contribution

Psychiatric morbidity following electrical injury and its effects on cognitive functioning

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Abstract

Objective: This study examines the prevalence of psychiatric morbidity in a large sample of electrical injury (EI) patients in three phases of recovery and its effects on cognitive functioning.
Methods: Eight-six self-referred EI patients received psychiatric and neuropsychological evaluations. Descriptive statistics were conducted to examine the prevalence of psychiatric morbidity. Polytomous logistic regression was used to identify predictors of psychiatric diagnosis. Between-subjects analysis of variances (ANOVA) was conducted to examine the effects of psychiatric morbidity on cognitive functioning.
Results: Seventy-eight percent of subjects warranted a psychiatric diagnosis. Long-term patients compared to acute patients were more likely to be diagnosed with two diagnoses than not having any diagnosis (OR=14.30, 95% CI 1.40–38.71). Patients with two diagnoses performed worse than both patients with a single or no diagnosis on all cognitive outcome measures ($P<.05$). Voltage level, chronic pain and litigation status did not predict psychiatric morbidity.
Conclusions: Psychiatric difficulties commonly emerge and persist following EI. EI patients with psychiatric conditions exhibited poorer cognitive performance as compared to EI patients with no post-injury psychiatric difficulties. Health care professionals need to devote careful attention to psychiatric and cognitive status when treating survivors of EI.

Keywords: Electrical injury; Psychopathology; Cognitive

1. Introduction

Psychiatric difficulties commonly emerge after traumatic injuries such as burns and traumatic brain injury (TBI), with prevalence of psychiatric disorders estimated as high as 50% in some studies. For instance, in a 30-year follow-up study of 60 TBI patients, Koponen et al. [1] found that 48.3% were diagnosed with a *Diagnostic and Statistical Manual* (DSM-IV) [2] Axis I disorder that began after the TBI. Similarly, in a follow-up study of 45 adult burn patients, Madianos et al. [2] found that the prevalence of psychiatric disorders reached 46% at both baseline and follow-up assessments. Thus, traumatic injuries constitute a significant threat to an individual's recovery and carry the potential of long-term changes in psychiatric status.

There has been paucity of research examining the psychiatric manifestations of another form of trauma, electrical injury (EI), despite occupational injury survey data that show that 2287 US workers died and 32,807 workers sustained days away from work due to EI between 1992 and 1998 [3]. Scattered reports suggest that as in other forms of trauma, EI is associated with significant psychiatric

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difficulties including major depressive disorder, anxiety disorders and post-traumatic stress disorder [PTSD] [4–7]. The rates of psychiatric morbidity following EI vary between studies, ranging from 57% [4] to 87.5% [8]. These differences appear to be largely due to varying sample characteristics, diversity of measures used to assess psychiatric status and differences in the statistical control for confounding variables. Specifically, Hooshmand et al. [8] administered the Minnesota Multiphasic Personality Inventory (MMPI) to a sample of 16 EI patients who were evaluated between 3 months to 1 year following their EI. The findings revealed that 14 of the 16 patients suffered from severe depression, and in 11 of the patients, the depression was severe enough to cause significant interference with occupational functioning.

In a study comparing 10 electrical burn patients to small samples of nonelectrical burn patients, chronic pain patients and inpatients on the adult psychiatry unit, Mancusi-Ungaro et al. [7] reported that the electrical burn patients showed the highest levels of distress on the clinical scales of the MMPI and endorsed more depressive symptoms relative to the other clinical samples. However, the small samples precluded any tests of statistical significance of the reported difference between the groups.

Only one study has utilized structured psychiatric diagnostic classification using the *DSM* following EI. Kelley et al. [4] reported that among a sample of 73 EI patients, 57% had psychiatric symptoms that warranted diagnosis of either depression or PTSD, and within this subgroup 31% had both diagnoses. However, this sample consisted of patients who were examined more than 3 months (and in some instances 9 years) following their EI, possibly limiting their generalizability to the EI patient population as a whole. Indeed, only one study has directly investigated the role that post-injury time interval may have on neuropsychiatric presentation after EI. Barrash et al. [9] examined the neuropsychological status in 18 survivors of high-voltage EI who were classified as *acute* (<1 month), *short-term* (1–6 months) or *long-term* (>6 months) related to when they were evaluated after their injury. Deficits in verbal learning and delayed recall of verbal information were present across various time intervals, and depression, anxiety and irritability were reported to be "widespread beyond the acute period".

To date, there are no published studies that have systematically examined the prevalence of psychiatric disorder in a carefully screened large sample of EI patients in both acute and post-acute phases of recovery. Moreover, in order to further our understanding of the neuropsychiatric sequelae of EI and improve rehabilitation interventions with this population, it is also important to examine the relationship between psychiatric morbidity and neurocognitive performance. Indeed, impairment in memory, attention and executive functioning has been commonly associated with a variety of mood and anxiety disorders in the general psychiatric population [10]. Relatively fewer studies have examined the relationships between these variables in clinical populations that suffered traumatic injuries. For instance, Rapoport et al. [11] reported a moderate positive correlation between self-report measures of depression and cognitive measures of attention, processing speed and verbal memory in a population of older adults who sustained TBI. Similarly, Ammar et al. [12] found poorer verbal memory performances among EI patient with PTSD as compared to EI patients without PTSD. These findings suggest that increased psychiatric difficulties may be associated with poorer cognitive outcomes among individuals suffering from traumatic injuries, and specifically among EI patients.

The current study examined the prevalence of psychiatric morbidity in a large sample of EI patients in three phases of recovery (acute, post-acute and long-term). We also investigated the relationship between psychiatric status and objective and subjective indices of cognitive functioning.

2. Method

2.1. Subjects

Subjects were 86 consecutive EI patients assessed by the local Electrical Trauma Research Program (ETP) between 1995 and 2005. Individuals eligible for this study were EI patients who received emergency and acute care services at the local medical center, as well as patients who were acutely managed at other institutions and later referred for post-acute multidisciplinary medical evaluation and treatment at our institution. One individual was excluded because his time since injury was greater than 3 S.D. from the group's mean time since injury. The sample was predominately male (87%). The average age of subjects was 39.45 years (S.D.=9.81). Subjects had an average of 12.66 years of education (S.D.=2.10), with estimated intellectual ability in the average range (mean WAIS FSIQ=96.07, S.D.=13.56). At the time of the evaluation subjects were an average of 20.66 months post-injury (S.D.=20.15). Twenty-six (31%) of the subjects were in the acute stage of recovery (≤3 months), 27 (32%) were in the post-acute phase of recovery (>3 to ≤24) and 32 (38%) were in the long-term phase of recovery from EI (>24 months). Nineteen subjects (22%) had undergone surgery following their EI (five in the acute recovery phase group, six in the post-acute recovery phase group and eight in the long-term recovery phase group). Fifty-three (62%) of the subjects were hospitalized (18 in the acute recovery phase group, 16 in the post-acute recovery phase group and 19 in the long-term recovery phase group). Seventeen subjects (20%) were taking psychiatric medication at the time of their evaluation (two in the acute phase group, seven in the post-acute phase group and eight in the long-term group). None of the subjects was on thyroid medication and none had abnormal brain imaging findings. None of the subjects was reported to have a concurrent personality disorder. Forty-eight (56%) of the subjects were in litigation (see Table 1 for a detailed presentation of clinical, accident and injury-related variables of EI sample).

Table 1
Clinical, accident and injury-related variables of EI subjects

	EI Subjects, *n* (%)
Accident-related variables	
Low-voltage injuries	46 (54)
High-voltage injuries	39 (46)
Head contact with electricity source	3 (4)
Injury-related variables	
Loss of consciousness	25 (29)
Traumatic head injury	1 (1)
Surgery	19 (22)
Hospitalization	53 (62)
Clinical variables	
Current chronic pain	43 (50)
Current pain medication	17 (20)
Current testosterone supplementation	1 (1)
Current psychotropic medication	17 (20)
Previous psychiatric diagnosis (depression and substance use)	5 (6)
History of learning disability	4 (5)
History of attention-deficit/hyperactivity disorder	1 (1)
Previous exposure to a traumatic event	2 (2)

2.2. Procedure

The current study was approved by the Institutional Review Board Human Subject Committee at our medical center. Prospective subjects were informed that their participation in the study is voluntary and written informed consent to participate in the study was obtained. Each individual received a comprehensive psychiatric evaluation by a board-certified psychiatrist as part of their work-up for the ETP. The evaluation included a patient interview, a review of previous psychiatric evaluations in order to establish the existence of a previous psychiatric diagnosis or previous usage of psychotropic medication when applicable, and the use of the Structured Clinical Interview for the DSM-IIIR Axis I diagnosis–McLean version [13]. In the present use of this tool, the wording of the diagnostic criteria has been modified to reflect *DSM-IV* [14]. As part of their evaluation at the ETRP, each individual was also assessed by a board-certified neuropsychologist and was administered a standard battery to examine cognitive abilities such as memory, attention, processing speed and executive functioning. The neuropsychological measures included the California Verbal Learning Test–2nd Edition [15], Stroop Color Word Test [16] and the Trail Making Test [17]. All subjects included in the study showed no evidence of malingering based on their scores on formal symptom validity tests.

2.3. Data analysis

Descriptive statistics were utilized to characterize the incidence of psychiatric diagnosis. A time since injury variable was created with three ordinal categories each denoting a recovery phase period: acute ≤3 months, post-acute >3 months and ≤24 months, and long-term >24 months (extending taxonomy first described by Pliskin et al. [18]). Polytomous logistic regression [19] was used to assess the predictive power of recovery phase from injury (time since injury) on psychiatric morbidity when other important injury-related predictors (reported voltage level, litigation status, previous psychiatric history, previous use of psychotropic medication, current level of pain, current use of pain medication) and demographic variables (sex, age, race, years of education) were included in the model. In order to create the most parsimonious model, terms were eliminated from the initial model using a backwards elimination procedure in which nonsignificant ($P>.10$) terms were removed until a final equation was reached. The model included a three-level dependent variable (no diagnosis, single diagnosis, two diagnoses) with no diagnosis as the referent group. Additionally, polytomous logistic regression was used to calculate odds ratios (ORs) and 95% confidence intervals (95% CIs) for each of the predictor variables. Next, between-subjects analysis of variances (ANOVA) was conducted to examine differences in cognitive performance between EI subjects with no psychiatric diagnosis, a single psychiatric diagnosis or two psychiatric diagnoses. For this analysis, we computed a composite *z*-score for three cognitive domains

Table 2
Predictors of psychiatric diagnosis among EI subjects

Adjusted variable	Single diagnosis (*n*=44) vs. no diagnosis (*n*=19)			Two diagnoses (*n*=22) vs. no diagnosis (*n*=19)		
	Odds ratio	95% CI	*P* value	Odds ratio	95% CI	*P* value
Age			.09			.13
≤40 (*n*=47)	1.00	Referent		1.00	Referent	
>40 (*n*=38)	2.84	0.84–9.57		3.02	0.73–12.50	
Education			.76			.04
≤12 (*n*=56)	1.00	Referent		1.00	Referent	
>12 (*n*=29)	0.83	0.25–2.76		0.19	0.04–0.91	
Months since injury			.08			.32
≤3 (*n*=26)	1.00	Referent		1.00	Referent	
>3 and ≤24 (*n*=27)	3.57	0.88–14.51		2.59	0.40–16.76	
Months since injury			.85			.02
≤3 (*n*=26)	1.00	Referent		1.00	Referent	
>24 (*n*=32)	1.41	0.35–5.60		14.30	1.40–38.71	

Note: Each variable is adjusted.

t3.1 Table 3
t3.2 Prevalence of psychiatric diagnosis in acute, post-acute and long-term recovery phase subgroups

t3.3 Diagnoses in EI subjects, *n* (%)	Acute (≤3 months)	Post-acute (>3 to ≤24 months)	Long-term (>24 months)
t3.4 With psychiatric diagnosis	17 (65)	23 (85)	26 (81)
t3.5 Without psychiatric diagnosis	9 (35)	4 (15)	6 (19)
t3.6 Type of psychiatric diagnosis			
t3.7 Depression	1 (4)	10 (37)	4 (13)
t3.8 PTSD	4 (15)	5 (19)	4 (13)
t3.9 Anxiety disorder	2 (8)	0 (0)	1 (3)
t3.10 Depression+PTSD	4 (15)	3 (11)	11 (34)
t3.11 Depression+anxiety	0 (0)	1 (4)	3 (9)
t3.12 Somatization	0 (0)	1 (4)	2 (6)
t3.13 Adjustment disorder	5 (19)	1 (4)	0 (0)
t3.14 Cognitive disorder NOS	1 (4)	0 (0)	3 (9)
t3.15 Mental disorder NOS	1 (4)	2 (7)	1 (3)

(verbal memory, executive functioning and attention) by first computing within-test *z*-scores followed by between-test *z*-scores. In addition, the effects of psychiatric morbidity on self-reported complaints of emotional, cognitive and physical symptoms were examined using ANOVA. Finally, Pearson correlations were used to examine the relationships between the different composite *z*-scores and time since injury as a function of psychiatric diagnosis. All analyses were performed using SAS [20].

3. Results

3.1. Prevalence of psychiatric morbidity

Seventy-eight percent of the total sample of EI subjects warranted a psychiatric diagnosis based on their evaluation. Of those with a psychiatric diagnosis, 52% had a single psychiatric diagnosis and 26% had two psychiatric diagnoses.

3.2. Predictors of psychiatric morbidity and symptoms profile

Recovery phase since EI was a significant predictor of psychiatric morbidity with long-term subjects significantly more likely to be diagnosed with two psychiatric diagnoses than not having a diagnosis as compared to acute subjects (OR=14.30, 95% CI 1.40–38.71). Specifically, EI subjects who are longer than 2 years post EI were 14 times more likely to be diagnosed with two psychiatric diagnoses relative to EI subjects who are in the post-acute phase of recovery (>3 months and ≤24 months). There was a trend for post-acute subjects to be more likely diagnosed with a single psychiatric diagnosis than not being diagnosed as compared to acute subjects (OR=3.57, 95% CI 0.88–14.51). Post-acute subjects were 3.5 times more likely to be diagnosed with a single psychiatric diagnosis relative to EI subjects who are in the acute phase of recovery (≤3 months) (*P*=.08; see Table 2).

t4.1 Table 4
t4.2 Performance on objective and subjective cognitive outcome measures as a function of psychiatric diagnosis

t4.3 Outcomes	Psychiatric diagnosis group						*P* value
t4.4	Never diagnosed		Single diagnosis		Two diagnoses		
t4.5	Mean	S.D.	Mean	S.D.	Mean	S.D.	
t4.6 Verbal memory composite	0.40[a]	0.84	0.07[a]	0.81	−0.45[b]	0.79	.01
t4.7 CVLT							
t4.8 Total learning across trials	53.63[a]	12.66	51.34[a]	11.63	44.32[b]	12.47	.03
t4.9 Long delay free recall	11.37[a]	3.02	10.61[a]	3.76	8.45[b]	4.23	.03
t4.10 Logical memory							
t4.11 Immediate free recall	18.25[a]	6.89	14.28[b]	6.19	11.23[c]	4.77	.002
t4.12 Delayed free recall	13.66[a]	6.11	11.94[a]	5.36	9.63[b]	4.58	.06
t4.13 Executive functioning composite	0.22[a]	0.72	0.22[a]	0.79	−0.59[b]	0.83	.001
t4.14 Stroop Interference Test							
t4.15 Color–word	37.84[a]	12.61	38.45[a]	13.54	26.41[b]	8.55	.001
t4.16 Trail Making Test							
t4.17 Trails B	75.02[a]	43.08	79.88[a]	47.67	119.18[b]	75.13	.02
t4.18 Attention composite	0.30[a]	0.81	0.17[a]	0.76	−0.55[b]	0.90	.001
t4.19 Stroop Interference Test							
t4.20 Word	92.63[a]	21.32	87.84[a]	20.53	72.45[b]	21.30	.01
t4.21 Color	70.21[a]	16.02	67.36[a]	16.38	53.45[b]	14.50	.001
t4.22 Trail Making Test							
t4.23 Trails A	32.10[a]	18.26	33.95[a]	16.03	46.90[b]	30.74	.04
t4.24 Neuropsychological Symptoms Checklist							
t4.25 Emotion	1.07[a]	1.53	3.07[b]	2.39	3.31[b]	2.56	.02
t4.26 Somatic	3.80[a]	4.41	10.62[b]	7.76	10.19[b]	8.26	.01
t4.27 Cognitive	1.67[a]	3.20	5.28[b]	4.98	6.31[b]	5.12	.02

t4.28 Note: Psychiatric diagnosis groups (no diagnosis, single diagnosis, two diagnoses). Composite scores were first created by computing within-test *z*-scores followed by between-test *z*-scores. Therefore, the composite scores will not sum to 0 as typically expected.

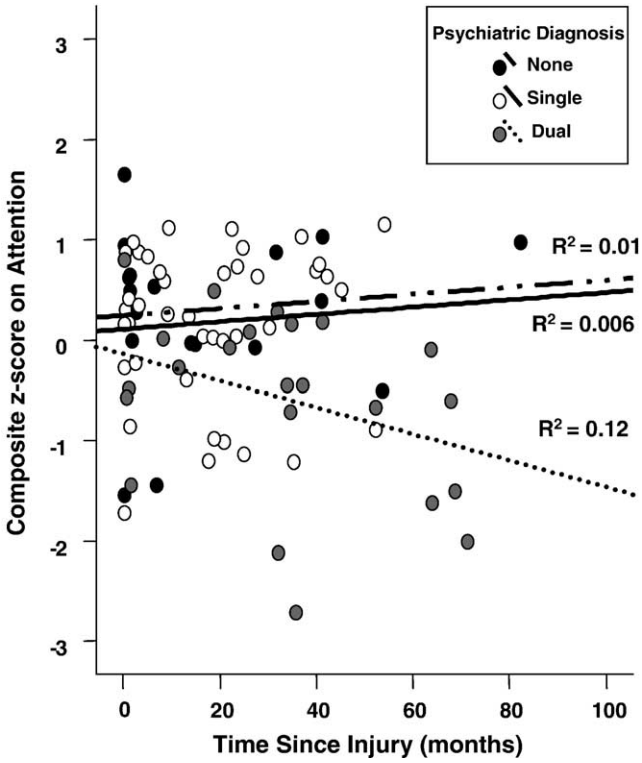

Fig. 1. Relationship between the composite *z*-score on attention and time since injury as a function of psychiatric diagnosis.

Reported voltage level, previous psychiatric history, previous use of psychotropic medication, current level of pain, use of pain medications and litigation status were not significant predictors of psychiatric morbidity

Exploratory descriptive analyses of psychiatric incidence were conducted for the three recovery-phase subgroups (see Table 3). Among EI subjects in the acute phase of recovery, 65% were given a psychiatric diagnosis. The most prevalent symptom profile was adjustment disorder (19%), followed by PTSD alone (15%) and depression and PTSD (15%). Depression alone was prevalent in 4% of the sample. In the post-acute phase of recovery, the most prevalent symptom profile was depression alone (37%) followed by PTSD alone (19%) and depression and PTSD (11%). Among subjects in the long-term recovery phase from EI, the most prevalent symptom profile was co-occurrence of depression and PTSD (34%), followed by depression alone (13%) and PTSD alone (13%).

3.3. Psychiatric morbidity and objective cognitive functioning

EI subjects with two diagnoses performed worse than both subjects with a single or no diagnosis on all cognitive outcome measures including verbal memory, executive functioning and attention ($P<.05$; see Table 4).

3.4. The association between time since injury and objective cognitive functioning as a function of psychiatric morbidity

There was a trend ($r=-.34$, $P=.10$) for a correlation between the composite *z*-score on the attention domain and time since injury (as a continuous measure) for subjects with two diagnoses (see Fig. 1). This association was not approaching significance in the no-diagnosis and one-diagnosis groups.

3.5. Psychiatric morbidity and self-reported cognitive, emotional and somatic concerns

EI subjects with two psychiatric diagnoses as well as EI subjects with one psychiatric diagnosis reported more subjective cognitive, emotional and somatic concerns, as compared to EI subjects with no psychiatric diagnosis (see Table 4). In both the low- and high-voltage EI groups, the most frequently endorsed somatic symptoms (i.e., symptoms that were endorsed by more than a third of sample) were blurred vision, difficulties with balance and acceleration (e.g., trouble walking, tremors, dropping things), difficulties with mechanoperception (e.g., numbness, "tingling" skin, burning skin, loss of feeling) and symptoms of muscle weakness, twitching and spasms.

4. Discussion

4.1. Prevalence and predictors of psychiatric morbidity

This study examined the prevalence of *DSM-IV* psychiatric disorders in a large sample of EI patients in all phases of recovery (acute, post-acute and long-term). The results demonstrate that psychiatric disorders are indeed common following EI. Our findings showing an incidence of psychiatric diagnosis in 78% of the sample are generally consistent with those reported by Kelley et al. [4] and are higher than those reported in TBI and burn populations [1,2].

Our findings also suggest that recovery phase from EI is a significant predictor of psychiatric morbidity. Specifically, EI subjects in the long-term phase of recovery were 14 times more likely to be diagnosed with more than one psychiatric diagnosis as compared to EI subjects in the acute and post-acute phases of recovery. Thus, EI patients in our study who are at a later phase in the recovery process are at a significantly greater risk for developing psychiatric complications which is consistent with a prior study documenting increased rate of emotional complaints in post-acute EI patients as compared to acute EI patients [18]. As reported in previous studies (e.g., Refs. [18,21]), there was no relationship between EI outcome variable, in this study presence of psychiatric disorder, and voltage level and litigation. Moreover, post-EI psychiatric morbidity was not associated with previous history of psychiatric disorder, previous use of psychotropic medication, and current chronic pain symptoms or usage of pain medications. Notably, the lack of predictive relationship between previous use of psychiatric medication and current presence of psychiatric disorder suggests that psychiatric morbidity worsens overtime regardless of whether or not there has been prior treatment with psychiatric medication.

Considering symptoms profiles, there was an increase in prevalence of combined PTSD and depression diagnoses

from the acute to long-term phases of recovery. The apparent progression in psychiatric difficulties among EI patients is of note given the literature demonstrating an inverse pattern among other clinical populations with traumatic injuries. For instance, in a cross-sequential study of 188 TBI patients, Ashman et al. [22] reported a decline in frequency of depression, substance abuse and PTSD over a period of 3 years post-injury. Similarly, in a review of the literature, Patterson et al. [23] reported that anxiety and depression were the most prevalent disorders in burn patients, with prevalence rates between 25% and 65% during the first year after injury with most symptoms subsiding after that period. Thus, EI results in a distinct pattern of increased psychiatric morbidity over time as compared to other traumatic injuries for which there is a reported reduction in prevalence of psychiatric symptoms over the course of recovery.

The differences in the prevalence and progression of psychiatric morbidity following EI as compared to other traumatic injuries highlight the distinctiveness of this clinical population. These findings raise important questions as to whether EI has unique properties that render it more likely to trigger chronic and progressive psychiatric distress as compared to other types of traumatic injuries. In that regard, Mancusi-Ungaro et al. [7] suggested that the experience of electric shock is the prototype of one-trial fear conditioning and thus may be a potent inductor of PTSD symptomatology. Another possibility is that the increased rate of psychiatric complications observed over time reflects central nervous system dysfunction that may be attributed to the delayed onset or progressive effects of EI. Additionally, the use of electroconvulsive therapy (ECT) is a model of how exposure to an electrical field can alter brain functioning. ECT has long been successfully used for the treatment of major depression [24]. Although the exact mechanisms mediating the therapeutic effects of ECT on emotional functioning are currently unknown, several hypotheses have been offered including current-induced changes in membrane electro-permeabilization [25] and alteration of neurotransmitter systems, including serotonin, dopamine and GABA [26,27]. In that sense, EI might be considered as a case of ECT gone awry, in which accidental exposure to higher voltages causes a brain insult that results in chronic and progressive alterations in neural substrates involved in emotional functioning.

4.2. Psychiatric morbidity and cognitive functioning

Our findings further suggest that EI patients with two psychiatric diagnoses exhibited poorer cognitive performances on indices of verbal memory, executive functioning and attention relative to EI patients with a single psychiatric diagnosis. These findings are consistent with a previous study indicating decreased verbal memory among EI patients with PTSD as compared to EI patients without PTSD [12]. The findings also demonstrated a trend for a correlation between performance on attention measures and time since injury in the combined diagnosis group only. This indicates that EI patients with multiple psychiatric diagnoses show a trend for a progressive decline in attentional skills well into the long-term phase of recovery.

This pattern of increased rate of cognitive impairment among EI patients with multiple psychiatric diagnoses is not surprising given the extensive literature documenting the association between psychiatric morbidity and cognitive dysfunction in the general clinical population. Therefore, the observed relationship between increased psychiatric morbidity and poorer cognitive outcomes is not unique to the EI clinical population and may represent shared phenomenological aspects between EI and other clinical populations.

The current findings also demonstrate that EI patients diagnosed with a single or multiple psychiatric conditions report increased rate of cognitive, emotional and somatic concerns. This pattern of increased rate in self-reported cognitive complaints among the two diagnoses group is consistent with the study's findings indicating more pronounced impairment on objective measures of cognitive functioning in the two-diagnosis group as compared to the single and no-diagnosis groups.

The biologic mechanisms that underlie the increased rate of psychiatric morbidity observed in long-term EI patients are not yet well understood. While questions still remain as to how electrical exposure affects central nervous system function, the presence of poorer cognitive outcomes in the more psychiatrically disturbed EI subgroup could be suggestive of more widespread and persistent central nervous system dysfunction in neural systems that underlie cognitive as well as emotional functioning.

4.3. Clinical implications, limitations and future research

There are several implications to the current study. First, the findings establish that psychiatric changes are prevalent among EI patients and that this prevalence increases over time. These findings compel health care professionals working with EI patients at all phases of recovery to devote careful attention to evaluating the patients' psychiatric status and to initiate appropriate interventions. Mental health professionals working with this clinical population should also be mindful of the possibility that EI patients presenting with comorbid psychiatric conditions and are further along into their recovery period may present with significant cognitive impairment encompassing several cognitive domains including memory, attention and executive functioning. Thus, neuropsychological evaluation and cognitive rehabilitation, when appropriate, should be considered an important part of caring for EI patients at all phases of recovery.

The main limitation of the current study is that it used a convenience sample of EI patients pursuing a multidisciplinary medical evaluation and treatment. As a result, it is possible that our sample was biased towards a higher rate of psychiatric distress compared to the EI population as a whole.

This limitation must be kept in mind when considering the findings.

Future research should directly investigate the clinical and phenomenological aspects of EI as compared to other traumatic injuries. In addition, the effects of EI on brain functioning, and in particular its effects on neural substrates involved in emotion regulation, need to be thoroughly examined through structural and functional neuroimaging investigations.

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